



June 1961

# **SIGNAL**

see page 5





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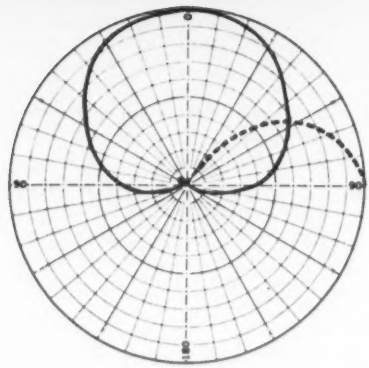
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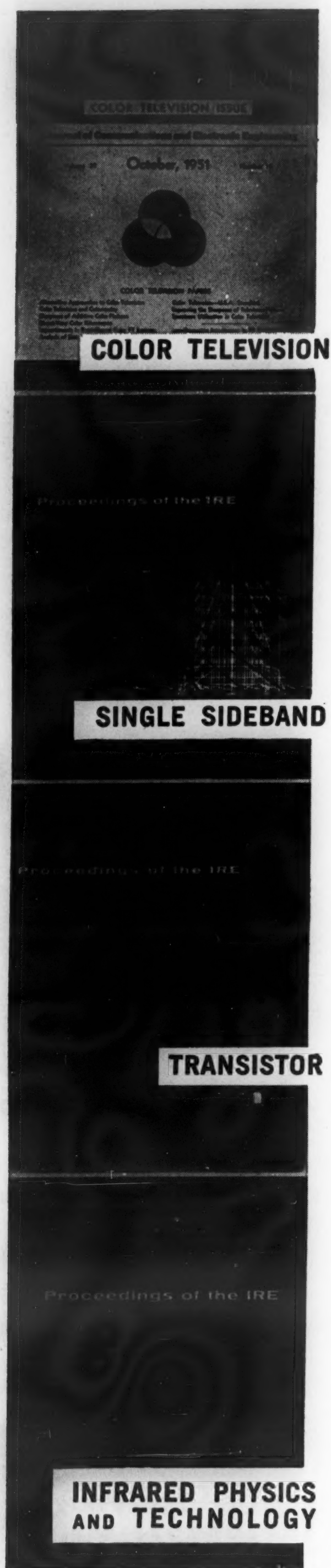
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	2N1700 (TO-5 Outline)		2N1701 (TO-8 Outline)		2N1701 (TO-3)** 2N1703 (TO-36 Outline)	
	Min.	Max.	Min.	Max.	Min.	Max.
Collector-to-Emitter Voltage (Reverse Bias) ( $V_{CEX}$ )	60v	—	60v	—	60v	—
Collector-to-Emitter Sustaining Voltage base open	40v	—	40v	—	40v	—
DC Current Transfer Ratio ( $h_{FE}$ )	20	80	20	80	15	60
DC Collector-to-Emitter Saturation Resistance ( $R_s$ ) ohms	—	10	—	5	—	4
Max. Transistor Dissipation*	—	5w	—	25w	—	75w
Max. Collector Current	—	1 amp.	—	2.5 amp.	—	5 amp.

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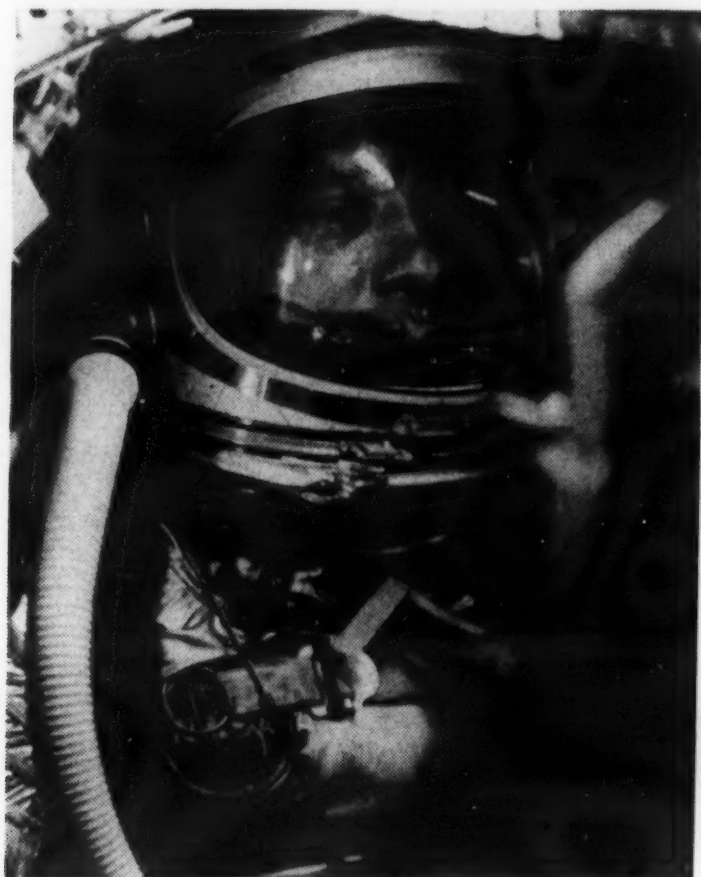


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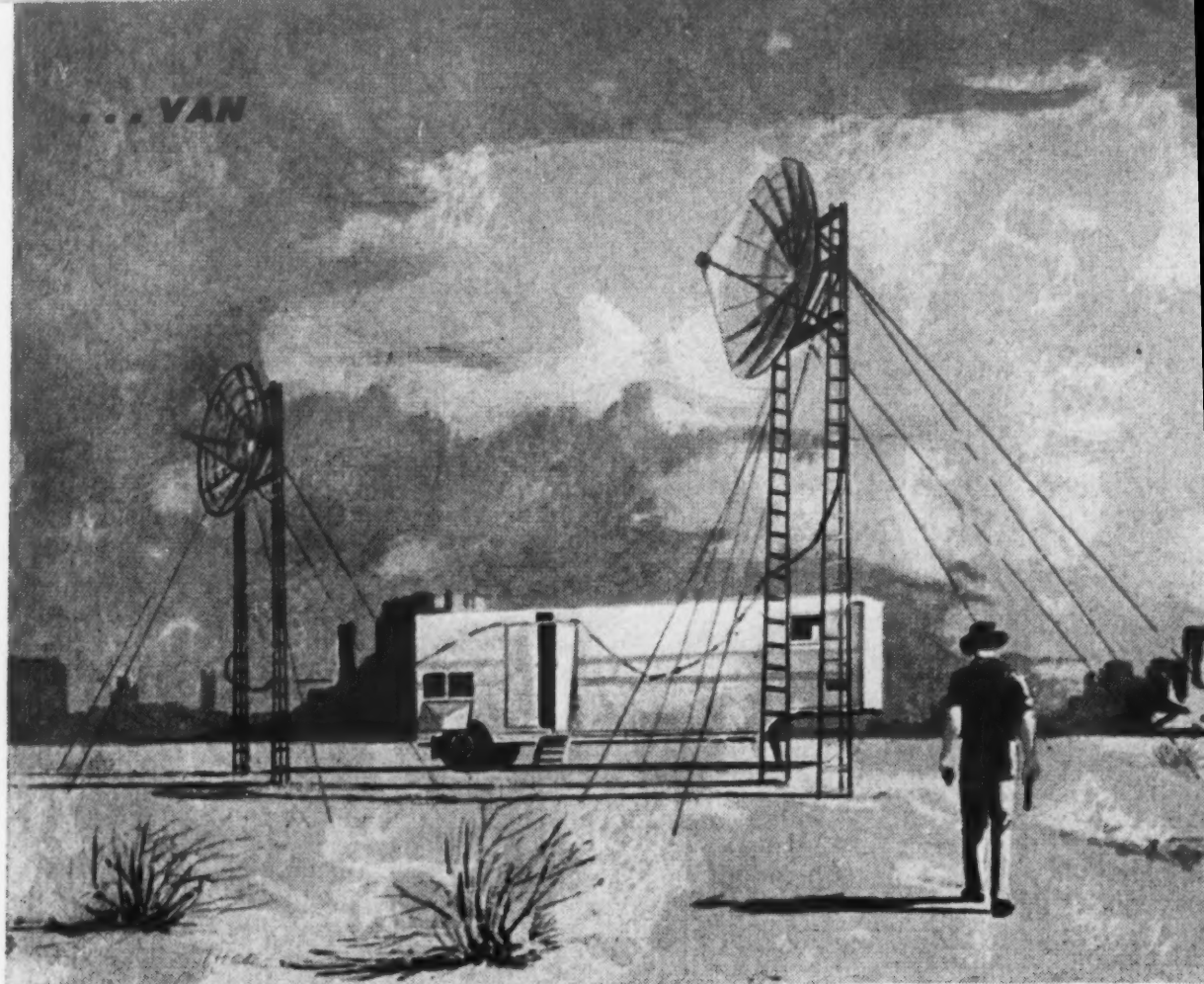
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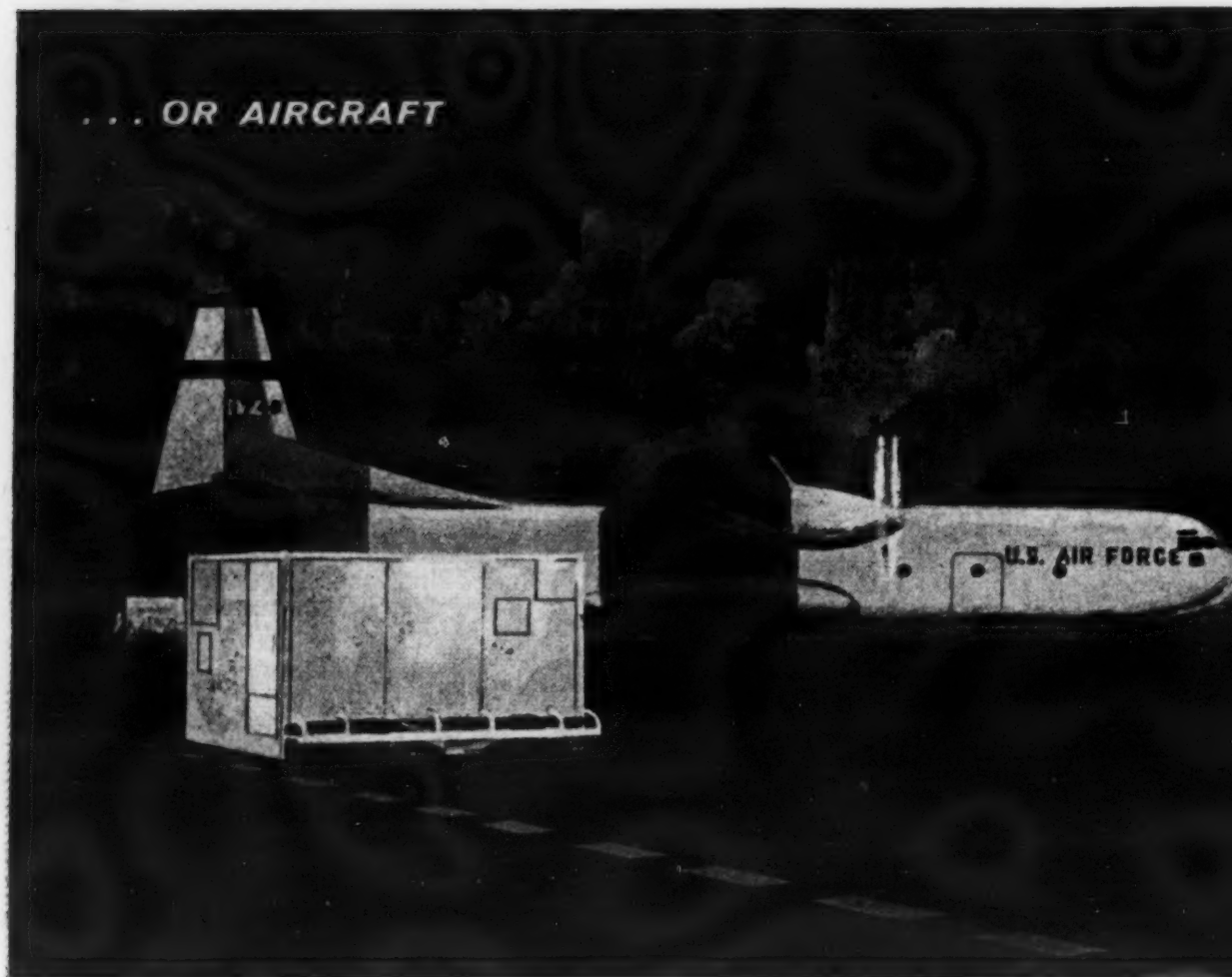


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by

FRED L. HESTER

President

Atlanta Chapter, Morse Telegraph Club of America, Inc.

## When the Telegraph Came to Atlanta

ONE HUNDRED AND SEVENTEEN years ago (May 24, 1844) when Samuel Finley Breese Morse transmitted the words "What Hath God Wrought?" on his crude instrument the thirty miles from Washington to Baltimore he solved one of civilization's greatest problems—overcoming time and space—and permitted man to send his thoughts and the news of his daily life to the far ends of the earth.

Morse's original idea was to have his instrument transmit the letters by means of combinations of short and long lines recorded on a moving paper tape which was activated by a weight-operated clock mechanism.

The telegraph key acted as a switch, opening and closing the circuit to operate a magnet. The magnet in turn pulled an inked stylus down on the moving paper tape to

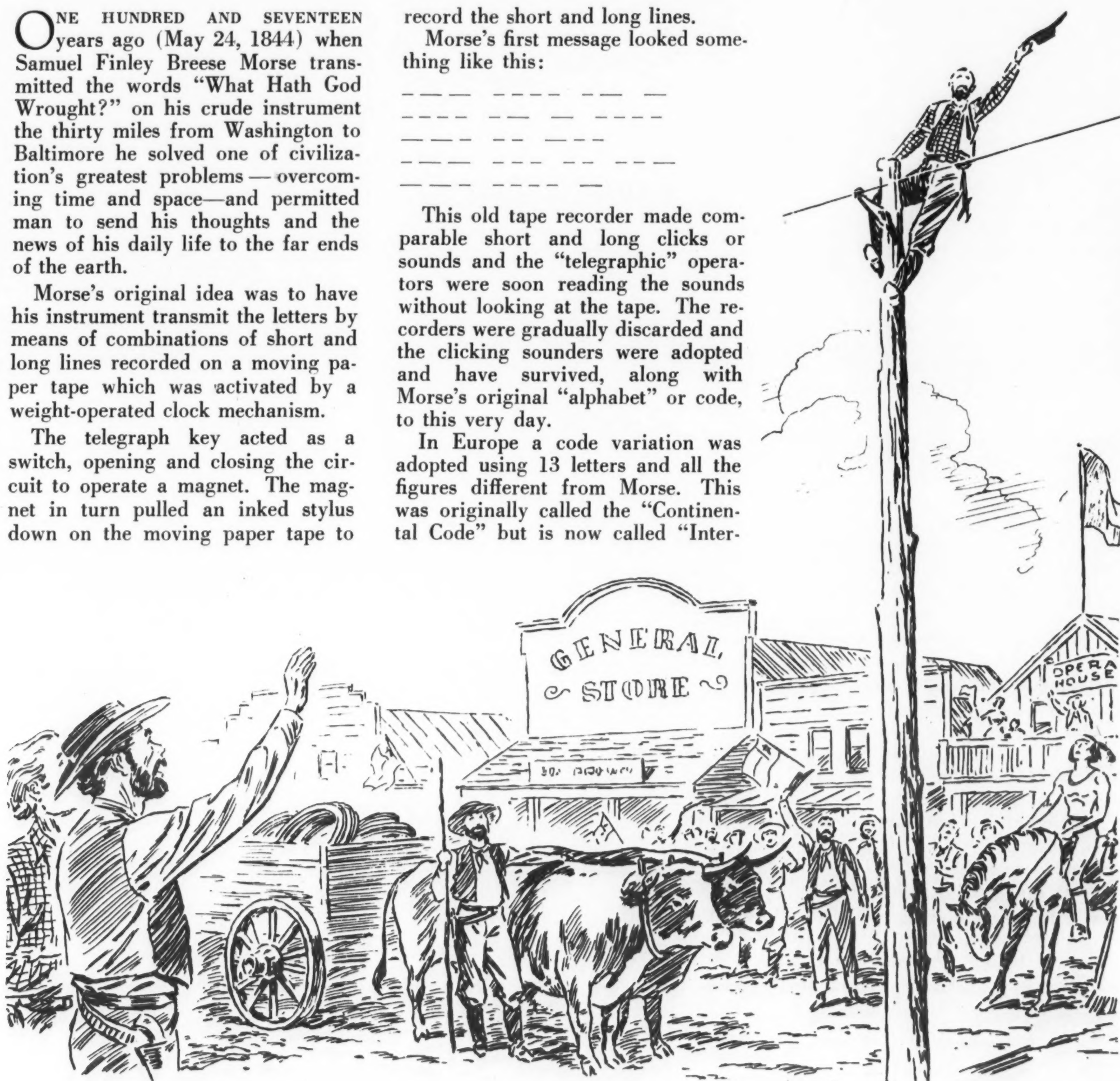
record the short and long lines.

Morse's first message looked something like this:

-----  
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-----  
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This old tape recorder made comparable short and long clicks or sounds and the "telegraphic" operators were soon reading the sounds without looking at the tape. The recorders were gradually discarded and the clicking sounders were adopted and have survived, along with Morse's original "alphabet" or code, to this very day.

In Europe a code variation was adopted using 13 letters and all the figures different from Morse. This was originally called the "Continental Code" but is now called "Inter-





national." It is used throughout the world in cable and radio transmission by boy scouts, Hams and the military. Morse's original code is generally referred to as "American Morse" and is now used only in the United States and Canada.

What happened behind the scenes during those 117 years when the deft fingers of the telegraphers tapped the keys that turned the tides of battle, controlled the trains, stimulated industry, and brought the news from the outside world? The southeastern states, particularly Georgia through which the first line south was constructed, have proven to be treasure ground for material. The dusty pages of history have yielded pay dirt flecked with sparkling romance and adventure that reads like a novel.

### First Line South

The first telegraph line south came through the Carolinas to Augusta (Ga.) and on to Savannah where the office was opened on March 22, 1848. From there the line crossed the cotton-rich southland to Columbus (Ga.), Montgomery, Mobile, and New Orleans where it was completed on July 19, 1848. This line, the longest telegraph circuit in the world, covered a distance of 1,716 miles.

In September, 1848 at a stockholders meeting, Daniel Griffin, of Columbus, Ga., was elected the first president of the Washington and New Orleans Magnetic Telegraph Co., and he moved to Washington. Old legends, and even the existing histories of the Columbus area tell of a Dr. Stephen Miles Ingersoll, related to the agnostic Robert Ingersoll, who claimed that he had telegraph circuits operating around his plantation near Columbus before 1844; and that it was he who had given Morse the idea of the telegraph during a stage coach trip between Columbus and Montgomery.

Daniel Griffin was a close personal friend of Ingersoll and it is indicated that because Ingersoll was given no recognition for his alleged part in developing the telegraph, Griffin soon resigned and returned to Columbus. Another Georgian, Elam Alexander, of Macon, was elected to succeed Griffin.

A telegraph line had been built north along the lines of the Central Georgia (now Central of Georgia) Railroad from Savannah to Macon where an office was opened on April 8, 1848. Macon's first telegrapher was David M. Ring, and the messenger was John Campbell Butler who advanced to a high position with the

telegraph company. Butler was also a writer and historian, and in 1879 published the *History of Macon and Middle Georgia*.

Butler apparently covered the first meeting of the Confederate Congress at Montgomery as a press telegrapher, and when the Confederate "Stars and Bars" flag was adopted he telegraphed its description to his sweetheart in Macon. She and members of the "Vineville Ladies," a social club, worked all night making what was perhaps the first Confederate flag which later was carried away to war.

The Savannah-Macon line was extended north along the Macon and Western (now Central of Georgia) Railroad to Atlanta, and the first office was opened in the M&W rock depot. The exact day in May, 1849 the office was opened in Atlanta has never been found, but some thoughtful historian did record that the first telegram was filed by Dr. Elisha Kent Kane, the noted arctic explorer, and was sent to his father in Philadelphia asking that supplies and equipment be made ready for a forthcoming ocean voyage. Atlanta's first telegrapher was Cornelius R. Hanleiter. His son, William, and Augustus Shaw were the first messengers in Atlanta.

Western Union's first office was opened in Atlanta in 1856 at the corner of Wall Street and Central Avenue with a telegrapher named David U. Sloan. His messenger was an alert youngster named Evan P. Howell who later became editor of the *Atlanta Constitution*.

### A Communications Center

Atlanta fast became a communications and transportation center. During the Civil War the city was a prime target for General Sherman's forces in their March to the Sea.

History remembers a young Atlanta telegrapher named R. O. Crowley who became something of a unique Confederate hero and perhaps our first military Frogman. He was very adept at rigging up bombs, particularly depth charges using gunpowder, batteries and old telegraph equipment. These under-water charges were placed in harbors and rivers. When the enemy sailed by, Crowley "closed the key" and brought disaster. Using a big charge of gunpowder in the James River near Richmond, Crowley and his men blew the U. S. Gunboat *Commodore Jones* completely out of the river.

Crowley was so valuable to the Confederacy that he carried an open letter addressed to the Federal com-

manders stating that if they captured Crowley the Confederacy would exchange a captured Federal general to get Crowley back to the South. This letter was personally signed by Jefferson Davis.

Another Confederate hero was a young telegrapher named George Ellsworth. He was attached to the famed Morgan's Raiders in their daring raids of more than one thousand miles into enemy territory. Ellsworth would cut in on the telegraph circuits, intercept military orders and information, and frequently send bogus information and military orders until he had the Federal commanders almost beside themselves with helpless rage.

### "Great Locomotive Chase"

A much dramatized event is the "Great Locomotive Chase" where Andrews' Raiders, a band of Federal spies, captured a passenger train at Big Shanty (now Kennesaw, Ga.) and started north toward Chattanooga, Tenn. Their aim was to destroy sections of the railroad, bridges and telegraph lines to cripple the Confederate supply line to their armies in Tennessee.

The engine on the stolen train was named the *General*. A group of Confederate soldiers headed by Conductor Fuller of the stolen train was soon in hot pursuit on the engine *Texas* which was running in reverse.

Andrews cut the telegraph lines and bluffed his way past many stations, even getting other trains into side tracks to permit his passing.

Edward Henderson, the 15-year old assistant telegrapher at Dalton had ridden the southbound train that morning to Calhoun checking the dead telegraph line and the unreported northbound train which Andrews had stolen.

While standing on the railroad platform at Calhoun, young Henderson saw the *General* roar by. In a few minutes the pursuing *Texas* came into sight. Conductor Fuller recognized the young telegrapher from Dalton, slowed down and snatched him aboard the engine. During the wild ride north to Dalton, Conductor Fuller wrote a telegram to the Confederate commanders at Chattanooga reporting the stolen engine and threat to the railroad. At Dalton, Henderson jumped from the moving engine and tapped out the message to Chattanooga, where a Confederate "reception" was arranged. However, the *General* ran out of fuel before it reached Chattanooga and the spies

(Continued on page 35)



In 1942,  
ITT's "Moonshine"  
was first used  
to make a  
single aircraft  
look like  
many squadrons  
on enemy  
radar screens.



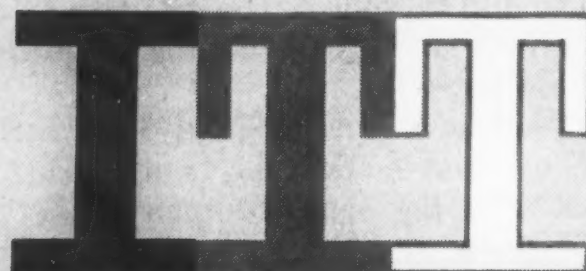
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## PART II

by MAJOR GENERAL R. T. NELSON  
Chief Signal Officer, USA

# PRICE IS AN OBJECT

**SYNOPSIS:** *Part I, published last month, discussed some of the factors which have contributed to the increasing cost of military equipment, such as the increased quantities of equipment authorized to military divisions and the higher quality of performance demanded of the new equipments. Other factors affecting the price include difficulties involved in writing cost-plus-fixed-fee contracts and fixed price contracts, the lack of time available for development work and the necessity for pushing the state-of-the-art more than ever before in order to develop the type of equipment needed. As a means of combating the increased costs of military equipment, a Product Review and Value Analysis Program has been established within the Office of the Chief Signal Officer to determine whether any of the requirements or standards can be reduced without adversely affecting operational reliability. Some results of the Program are discussed in Part II.*

**I**N DEALING WITH the new technology factor in increased costs, we use the Product Review and Value Analysis Program. Essentially, this is a self-examination process conducted by specialists in manufacturing techniques for diagnosis of a design or model during development to determine whether we are building excessive cost into it—and whether the result of our development will be more costly than the need justifies. One of the questions always asked in these reviews and analyses, during all levels of developments, is whether the *new* provides a really substantial benefit over the *old*. The critique needs to be exploited to the maximum extent for its contribution to cost reduction.

In a well-rounded program to initiate cost reduction in the procurement phases, I have asked my technical people to eliminate the frills and nice-to-have items and to pay particular attention to insure that the proposed changes in specifications which increase cost are not simply marginal, but are improvements which will increase combat effectiveness.

### *Good Results Already*

Some good results from this program have already been obtained. As one example, we have developed an austerity model, or Cost Reduction model of the Walkie-Talkie Radio Set, AN/PRC-10, which we designate the AN/PRC-10A. The austerity model differs from the original in that it contains four instead of five IF amplifiers, one instead of two calibration oscillators, and it has only one automatic frequency control driver circuit. Although slightly different in potential capability and in appearance, the two models are functionally identical and still do the required job with equal reliability.

Whereas the Army paid \$500 each for 11,800 sets of the original model, the contract for subsequent production with the same company calls for the purchase of 4,370 sets at \$404 each—a considerable cost reduction savings on one small contract.

As another example, by means of a Production En-

gineering Measures Contract it was possible to reduce the unit cost of a certain transistor from \$35 to \$15 each. The Production Engineering Contract cost the Army more than half a million dollars. However, based on present procurement of 50,000 units per year, savings are estimated to be one million dollars annually.

### *Impact of Overruns*

Now, what are we doing and what do we propose to do about our contractual difficulties and the critical problem of "overruns" which I mentioned?

First, let us examine the impact of overruns on our operations which makes this problem so critical in the research and development area where they generally occur.

One result is an unbalanced program. Because we are given a fixed amount of money for our research and development work each year, an overrun or unexpected increase in the cost of a particular development contract means additional funding to complete that contract. Additional funding can usually be accomplished only at the expense of other important, but lower-priority projects, with an unbalanced result.

Another effect of overruns is the reduction in the number of models or systems that will be delivered under the contract—that is, unless the additional funding is provided. Obviously, any reduction in the numbers of models complicates the test and evaluation series, with resultant slippages in programs.

Overruns may be of such magnitude as to cause further slippages because of the consequent shortage of funds. In such cases, some essential work must then be postponed to the following years when, it is to be hoped, the necessary additional funds will be received.

Finally, overruns result in an undesirable competition for funds—more often than not between unrelated projects where a fair comparison is difficult.

Having noted the critical impact of overruns on our operations, let us look at their essential causes.

The first concerns changes in the users requirements and changes in technical concepts. In complex devel-



opments, particularly where the work is somewhat beyond the current state of the art, new technical concepts, if warranted, must be incorporated into the contract. Changes in both requirements and in technical concepts invariably increase the cost of the contract.

The next factor has to do with estimating the cost of R & D tasks. This is a difficult task at best. Contractors, knowing that feasibility in most cases has not been established, realizing that the technical requirements in all probability will be changed, and recognizing the competitive pressures that exist within the industry, are inclined to underestimate costs—and then depend upon changed requirements and funding of overruns to keep the contract in effect until completion.

Finally, increased costs are frequently brought about by an upward adjustment in the overhead rate, determined as a result of a post-contract audit.

### ***Greatest Difficulty in Planning***

It should be recognized that the term "overruns," as often used, refers to at least two distinct classes of expenditures beyond the initially contracted amount: one where additional funds are required because of specific changes in the scope of a contract—and another class, where there is a lack of funds to complete a contract without any change in technical scope. It is those increased costs occurring in a contract without any change in technical scope that present us with greatest difficulty in planning.

As a result of considerable deliberation about this problem, a number of actions have been taken to alleviate this situation.

1. For one thing, more adequate specifications must be written. Whenever adequate technical specifications cannot be written, particularly on cost-plus-fixed-fee contracts, performance specifications will be considered. Technical requirements are now being written as specifically as possible to avoid misinterpretation and multiple approach solutions which increase costs. Where insufficient information prohibits adequate technical specifications, a study contract will be considered or in-house research performed to obtain the required information.

2. Serious consideration will be given to contracts for less costly and less time-consuming feasibility models—and more use of feasibility models. Such contracts will be let whenever possible and reasonable. By so doing we hope to reduce costly development time. It was largely due to the employment of feasibility models that we were able to place Courier in orbit in a remarkably short time.

3. Increased contract supervision has been directed. More timely actions are needed. Whenever the Signal Corps is faced with the prediction of an overrun, serious and immediate consideration will be given to changing the scope of the contract and possibly scaling down requirements, including the number of models.

4. Within the last few months we have secured approval from the Bureau of the Budget to require contractors to report actual expenditures, as compared to those forecasted, on a monthly basis rather than quarterly. This will provide us up to 60 days savings on reprogramming action if such is required, or will enable us to halt marginal features of a project up to 60 days earlier than under previous procedures.

Other measures relative to the criteria to be used in the choice of a contractor, and provisions for adjustments in contract terms on the basis of performance progress, are being considered as a means of establishing better cost control. A check list of the most frequent causes of overruns has been drawn up for use in all present and

future contract negotiations concerning development efforts.

All in all, these measures we have taken, or are contemplating, will have a considerable effect upon our contract operations.

Related to the problem of overruns, and the factor of time, is the effect these have on over-all lead time. The length of time required to put new weapons and equipment in the hands of troops is excessive. Many of the same factors contributing to increased costs also contribute to a longer lead time—that is, from the inception of an idea to operational use of materiel.

These are—(1) complexity and rigidity of qualitative requirements and military characteristics, (2) insistence on perfection in design and performance when excellence would suffice, and (3) inability to provide adequate funding.

Other contributing factors to excessive lead time are excessive testing of materiel prior to acceptance for production—and the time lag between completion of development and initiation of production. This is solely an Army problem.

As I have already pointed out, these are matters which are currently of paramount concern to Army officials at the highest level. They are matters of paramount concern to all of us because they affect the quality and adequacy of our support to our combat forces. They are matters of compelling concern to you because of their effect upon the number and amounts of contracts that can be let—and to whom. They are matters affecting contract administration and performance.

All of this means that it is imperative that the cost-plus-fixed-fee contract be refined to provide the contractor with a more valid basis for estimating costs and making a more accurate determination of the proper pricing level.

### ***Opportunity for Definitive Arrangement***

There may be some among you who will recoil at the thought of more contract supervision. I hope not. I hope you will instead look upon these measures as an opportunity for a more definitive and more agreeable working arrangement with fewer uncertainties and risks.

I hope I am not frightening any prospective contractors, particularly those from smaller companies who may be contemplating making bid proposals and have never before done so. We welcome all comers—large or small—providing they have promising talent, good potential, and a healthy desire to get ahead. We encourage small companies to bid because more small businesses at work for us provide us with a broader industrial base.

Daily information is available on planned procurements through the Department of Commerce. For any who desire to do business with the Government, their publication, entitled "Synopsis of Proposed Procurements, Sales, and Awards," is a good investment. Costing only \$10 a year, it includes all planned Army procurements of \$10,000 or more. You need simply refer to this publication for leads on planned production procurements that may be within your capabilities. Additional information on any Signal Corps procurements can be obtained through the Midwestern Regional Office of our U. S. Army Signal Supply Agency in Chicago.

We are endeavoring to get our house in better order—and we solicit your assistance and support. We ask that you actively explore and consider all possible ways in which corners may be cut or development and production costs reduced—that you help us to eliminate any non-essentials—that you be alert to opportunities for getting

(Continued on page 32)



# FCC RELATION TO space COMMUNICATIONS



## SIGNAL STAFF REPORT

*In recent years, the moon has played an important role in space communications R&D.*

THE FEDERAL COMMUNICATIONS COMMISSION activities in connection with space communications have increased greatly because of the many new and unique problems posed by rapid technological and scientific developments in this field.

Although the Commission is not responsible for any over-all space program or any particular space vehicle launching project, the mounting activity in space communication has an impact on its regulation of non-Government radio users. This stems from its obligations under the Communications Act which, among other things, requires the FCC to "study new uses for radio, provide for experimental uses of frequencies, and generally encourage the larger and more effective use of radio in the public interest" as well as to "make available, so far as possible, to all the people of the United States a rapid, efficient, Nationwide, and world-wide wire and radio communication service."

This involves the allocation and assignment of frequencies for space communication and the authorization of privately conducted research and experimentation looking toward the use of natural or man-made satellites to provide civil communication services on a regular basis. Radio signals "bounced" or relayed from such satellites would permit the transmission of large amounts of telephone, telegraph and other traffic, including television, over great distances. Such developments present a new and complex array of technical problems. Not the least of these is finding suitable and sufficient frequencies and insuring compatibility between space communications systems and surface systems so that the public interest will best be served. Many regulatory problems will flow from adding space communications to radio's already manifold uses.

### **Coordination and Cooperation**

The achievement of these purposes involves both national and international considerations. Consequently, the Commission is working closely with the interests involved.

This coordination and cooperation requires particularly close relationship by the FCC with the National Aeronautics and Space Administration (NASA), which directs the Nation's non-military space effort. On February 28, 1961, the FCC and NASA announced a joint "memorandum of understanding" for delineating and coordinating their respective responsibilities in civil communication space activities.

Other interagency activities include FCC participation in the following:

The Telecommunication Coordinating Committee (TCC) of the Department of State, which has an ad hoc working group under the chairmanship of FCC Commissioner T. A. M. Craven to draft foreign policy recommendations on space communication systems;

The Telecommunication Planning Committee (TPC), which advises the Office of Civil and Defense Mobilization (OCDM), with FCC representation on space study panels;

The FCC and the OCDM have joint responsibility for national frequency allocations, with staff work through joint meetings of FCC representatives with the Interdepartment Radio Advisory Committee (IRAC) and its Subcommittee on Frequency Allocations (SFA);

The U. S. Committee for Study Groups IV and VIII of the International Radio Consultative Committee (CCIR) of the International Telecommunication Union (ITU), with which the FCC participates through subgroups;



The Space Science Board (SSB), of which the FCC's Chief Engineer is a member of the International Relations Committee concerned with international basic space research activities, working internationally through the Committee on Space Research (COSPAR);

The International Radio Scientific Union (URSI), which has FCC participation and, in turn, is a member of the International Council of Scientific Unions (ICSU); and

The National Bureau of Standards Central Radio Propagation Laboratory, with which the FCC maintains liaison through membership on the Interdepartment Council on Radio Propagation and Standards.

#### **International Considerations**

The International Administrative Radio Conference, held at Geneva in 1959 under the auspices of the ITU, adopted an international table of frequency allocations which, for the first time, provided bands of frequencies for space and earth-space services. These bands, however, are for research purposes only and are useful principally for tracking, control and telemetry functions. Although no bands were allocated internationally for space satellite relay communication, a special ITU Administrative Radio Conference was scheduled tentatively for late 1963 to deal specifically with space problems on the basis of developments as of that time. At the request of the Department of State, preparatory work toward formulating the United States position at that conference has been initiated jointly by the FCC and the IRAC.

Domestically, steps have been taken by the FCC to implement the 1959 Geneva Radio Regulations nationally, pending ratification of that treaty by the President upon the advice and consent of the Senate.

#### **FCC Proceedings**

As a result of developments in space communications during 1960, the Commission reopened its proceeding in the general inquiry relative to the allocation of frequencies above 890 megacycles (Docket 11866) to determine, in the light of evidence then available, whether the frequency requirements for communication via space satellites would require some additional classes of users to establish communications systems on frequencies between 1,000 and 10,000 mc. After a careful analysis of all the evidence then on hand, the Commission concluded that its earlier decision need not be modified at that time.

However, in view of rapid developments in space communications, the Commission instituted an inquiry (Docket 13522) as to space frequency needs on a longer-range basis. This information will assist the Commission in its preparatory work leading to a United States position for future international conferences on space needs and usage. The inquiry was augmented to consider conditions for sharing space bands with other radio

services and whether protected areas might be established and held in reserve for future earth terminals for civil communication systems using space relays.

#### **Experimentation**

The Commission is encouraging experimentation in this new field in the hope that private industry can develop considerable additional technical information which will serve to further the country's over-all space program.

In this regard, an experimental authorization was granted in January of this year to the ITT Federal Laboratories, Nutley, N. J., to bounce signals off the moon and passive (non-radio-equipped) earth satellites for basic research and study.

Also in January of this year, an experimental authorization was granted to the American Telephone and Telegraph Co., to permit it to go forward with plans to develop an experimental program wherein earth terminal facilities at Holmdel, N. J., would transmit to and receive from active (radio-equipped) earth satellites which also are undergoing development by AT&T.

Last month the Commission authorized Westinghouse Broadcasting Co., Inc. to operate an experimental radio station for earth-space radio communication research. Located near Linthicum, Md., the station will be used for bouncing signals off the moon and passive earth satellites.

#### **Monitoring**

Another FCC activity is the continued monitoring of channels being used for space communication. This started with its long range direction finding work in tracing Sputnik I, before the Government established special installations to track space objects. Commission monitoring is to prevent unauthorized use by other stations of channels employed for space communication, and to identify and locate sources of interference on those channels. At a number of FCC monitoring stations, special equipment includes sensitive receivers, high gain directional antennas and automatic frequency scanning devices.

#### **Radio Astronomy**

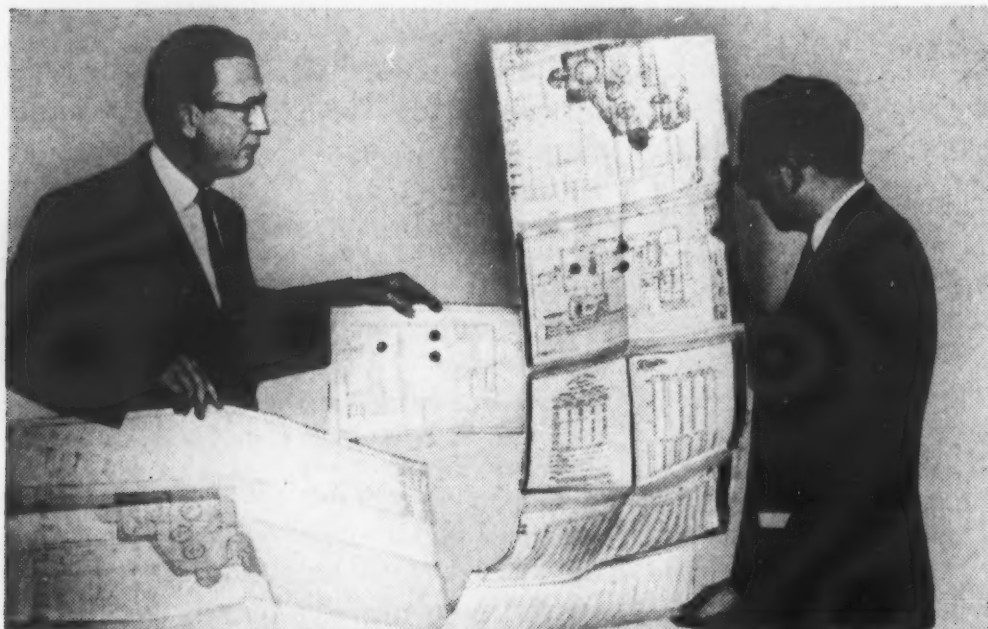
Related to space communication is the use of radio in astronomy. The Geneva 1959 conference, for the first time in history, provided for protecting specific frequencies utilized in radio astronomy. The FCC has completed the groundwork for putting these provisions into effect domestically when the Geneva agreement is ratified by the United States.

Meanwhile, the Commission has adopted rules to minimize interference to frequencies used for radio astronomy observations in this country, particularly at the National Radio Astronomy Observatory at Green Bank and the Naval Radio Research Observatory at Sugar Grove, both in West Virginia.



**IN AUGUST, WATCH FOR SIGNAL'S  
CONVENTION REPORT ISSUE  
COVERING  
PANELS  
SPEECHES AND GENERAL NEWS**





High priority, graphic communication data covering the full spectrum of business messages — from full scale drawings to two letters at a time — are examined at a demonstration of Alden High Speed Facsimile.

## Now!... Practical, High-Speed Facsimile for the High Priority Graphic Information of Government, Industry & Commerce

In facsimile — the key to cost is utilization of transmission lines and equipment. So far, the biggest expense has been line cost. The greatest bar to full utilization of systems has been lack of flexibility in equipment.

**Line costs are now plummeting** — through the great increase in private "voice" networks, the recent availability of private microwave channels, and the filing of tariffs by A. T. & T. Company of low cost, broad channel communication links in their "Telpak" offering.

### Alden facsimile equipment has the proven flexibility . . .

to take documentary copy of any size and shape, to operate on any channel (microwave, "voice" channel, broad channel), to operate at any speed (from 8 min. letter to 2 letters/min. or at any higher speed) with proven, practical designs . . . (standard equipment for the U. S. Weather Bureau on 2 national and territorial networks).

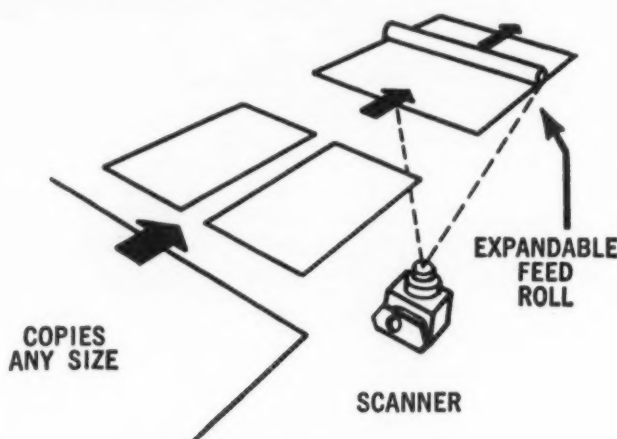
### Alden equipment handles the entire spectrum of high priority graphic information.

Not restricted to letter size copy, Alden Flat Copy Scanners readily accept originals of any length, width or thickness. They have the flexibility to transmit everything from full scale layouts and plan drawings to 2 letters at a time or small size messages whether shingled or in parallel. Messages can be fed continuously or selectively scanned for greatest flexibility. The tremendous variety of messages that can be sent results in *highest utilization of equipment* for all high priority graphic information.

### Alden equipment can load match the traffic of any system.

Not only the entire spectrum of size, length and thickness of copy can be

COPY CAN BE FED CONTINUOUSLY IN ALDEN FLAT COPY SCANNER 19" WIDE



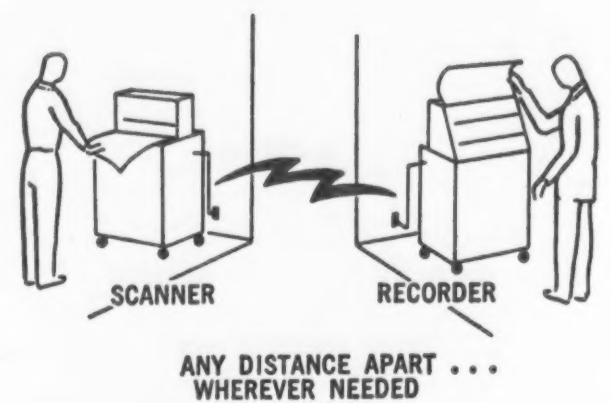
handled — but the most practical speed for the load can be chosen from standard Alden equipment to get the *highest utilization* of the communication link or channel selected. Alden equipment is not fixed at high or low speed. Through the use of modern tape equipment the ability to store at one speed and transmit at another gives *complete flexibility* to any systems layout — insuring highest utilization.

### Alden equipment is designed as self-contained, modular units . . .

with low maintenance and running costs. Scanners can be placed wherever information is developed — fed into the facsimile communication system or network — and recorder placed wherever information needs to be utilized.

### The ability to get highest utilization —

from Alden equipment does not come about by accident, but is made possible by the techniques Alden has pioneered.



### Alfax Paper and Alden Recording Techniques

From 1930 on, Alden has continuously engaged in facsimile development and application. Most significant was the development of Alden "A" Recording Papers — the first and only stable and high speed electro-sensitive recording paper, which combined with Alden "adjusterless" Recording Techniques and simplified Flat Copy Scanning — form the basis for the important breakthrough in practical facsimile equipment and systems.

In 1946 ALDEN ELECTRONICS was set up as a manufacturer's manufacturer to supply systems, equipment, component recorders, scanners and their elements to users, OEM, and R&D groups in facsimile and instant graphic recording fields. This company can serve as the key to exploiting the new horizons opened by Alfax "A" Paper (1) and Alden Recording and Scanning techniques (2) and to benefit from the electronic packaging and manufacturing techniques of the original Alden Products Company (3).

**TODAY** — Alden Electronics' equipment is standard throughout two national U. S. Weather Bureau facsimile networks. Backed up by over 200 service centers throughout the nation, Alfax Paper and Alden Recorders are also superimposing a whole new strata of instant graphic "quick see" recording devices in every scientific field from Oceanography to Radio Astronomy.

It is the fastest growing company in the facsimile field and is being joined by outstanding leaders who find that Alden recording techniques and Alfax "A" papers can expand and develop their markets.

**1. ALFAX PAPER & ENGINEERING CO., INC.** making Alfax paper available to all for use or re-sale without restriction.

**2. ALDEN RESEARCH FOUNDATION** providing an integrated and coordinated program for the use of Alden techniques and know-how.

**3. ALDEN PRODUCTS COMPANY** making available the basic components to mount, house, fasten and connect electronic circuitry so that equipment is simple to roll-in, plug-in, operate and maintain.



can serve you as the key element of the only integrated team for providing every essential element from basic parts to complete systems in the facsimile field.

We invite your inquiries.

**ALDEN RESEARCH CENTER**  
Westboro, Massachusetts U.S.A.

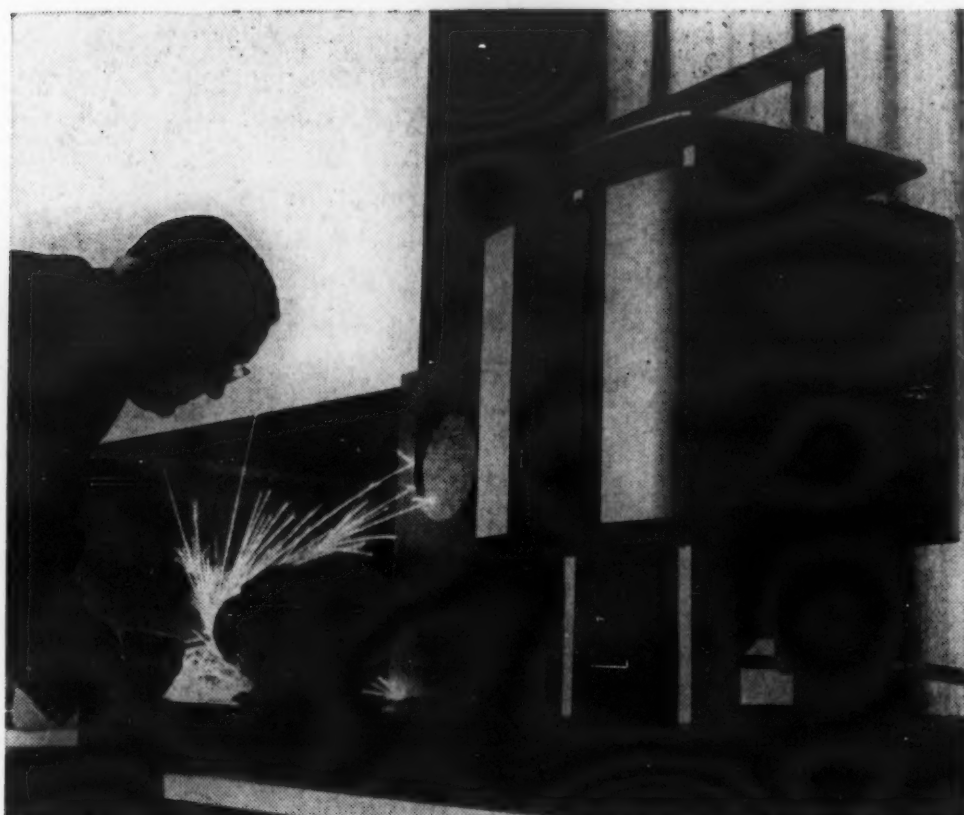


# Direct Energy Conversion

PART II

by CHARLES DEVORE  
Vice President, CREI Atomics  
The Capitol Radio Engineering Institute

*Dr. S. J. Angello, project manager, Westinghouse, demonstrates a 100-watt, gas-fired thermoelectric generator by using it to power a grinding wheel.*



**SYNOPSIS:** *Part I, published last month, described three direct energy conversion devices—solar cells, fuel cells and thermoelectric generators. The types of materials used in these three devices and the names of companies developing the devices were set forth. Part II discusses work being done with a fourth direct energy conversion device, thermionic converters, and describes the SNAP (Systems for Nuclear Auxiliary Power) program.*

**T**HERMOELECTRIC AIR conditioning and refrigeration have already been mentioned. Peltier cooling can also be put to use in small thermoelectric temperature-controlled chambers. Two such devices were reported at the recent Symposium on Thermoelectric Energy Conversion. One, constructed and tested at the Diamond Ordnance Fuze Laboratories, was designed for applications to microminiature circuitry, such as the crystal for a precision oscillator. The other was constructed by Texas Instruments for the Army Ballistic Missile Agency. It was designed to maintain the internal air at any preset temperature between 0° and 100° C. In the electronic field, thermoelectric cooling can be used for cooling transistors, electron tubes, infrared detectors, and

quartz crystals. At this same meeting, Westinghouse showed a line of 5-watt, 10-watt, 50-watt, and 100-watt thermoelectric generators for industrial applications. The company had also announced delivery of 50- and 100-watt units for industrial use to charge batteries in microwave relay stations and to protect pipelines against corrosion by creating an electrical charge which neutralizes the corrosive action on the pipe.

Materials development is still a problem confronting engineers working on thermoelectric conversion, although good progress is being made. A most significant find was the discovery of a high melting point material which also has a low thermal conductivity. Samarium sulfide with a melting point substantially above 2000° C is reported to have a room temperature thermal conductivity as low as 0.005 watt per centimeter per degree C, and a normal variation with increasing temperature. But 2000° C appears to be an upper operating limit, at the present, for thermoelectric generators.

## Thermionic Conversion

Thermionic converters, or generators, normally operate at higher temperatures, close to 3000° C. Thermionic generators produce electrical power by using the electrons emitted from the surface of the material when it is heated to a high temperature—a phenomenon observed by Thomas

A. Edison in 1883. They share with thermoelectric devices the characteristic that the working fluid consists of electrons; they differ in that the heated electrons are emitted into a vacuum—or gas—rather than into a solid.

To generate substantial amounts of power by the thermionic process, it is necessary for large numbers of electrons to flow from the hot cathode to the cold anode. Because the electrons are all negatively charged, they repel each other and build up a charge, known as space charge, that limits further flow. One method of overcoming this space charge problem is to put the cathode and anode very close together. The spacing required, however, is a matter of a few ten-thousandths of an inch, a technique that calls for expensive machining. Such close spacing, too, is virtually impossible to keep uniform between two surfaces over a large area, particularly at high temperatures.

A second approach to the space charge problem is to neutralize it by introducing a cloud of positive ions, or plasma. Cesium gas is used for this purpose by RCA and General Electric; cesium is the most easily ionized of all the chemical elements.

Calculations indicate that the thermionic process could have a theoretical efficiency of 40 per cent or higher. Efficiencies of up to 13 per cent have been demonstrated, but only in the laboratory. The best that



is available today is a close-spaced diode with an efficiency of 2 per cent.

Again, the problem of materials development is present. Materials are needed that will be capable of operating for long periods of time at temperatures up to 4500° F. Then, too, the plasma doesn't behave as expected. The advantage, however, of thermionic conversion is a strong stimulus to continued research and development. The diode, potentially, is the lightest weight of all energy converters. Design projections indicate less than one pound per kilowatt, which would make those devices the obvious choice for space craft.

### **Nuclear Energy**

The newest and most powerful source of energy is, of course, nuclear energy. Direct conversion devices utilizing heat energy can obtain that heat from the decay of radioactive isotopes or from fission processes in nuclear reactors, and—it is hoped—ultimately from the thermonuclear or fusion process.

The fission process itself possesses energy equivalent to a temperature of about 1000 billion degrees F, so there is no problem from limitation of the temperature of the heat source. Utilization of that potential heat energy is another matter, however, depending—again—on the development of materials capable of withstanding higher temperatures.

The significance of nuclear energy to direct energy conversion was recognized by the Joint Committee on Atomic Energy as a part of its hearings on "Frontiers in Atomic Energy Research," held in March of 1960. Perhaps the best known program in the field of utilization of nuclear energy for direct conversion is the Atomic Energy Commission's program SNAP—for Systems for Nuclear Auxiliary Power.

### **Radioisotopic Power**

One phase of this program involves the utilization of the heat released as a radioisotope decays. The feasibility of producing practical power from radioisotopes was demonstrated early in 1959 with the initial operation of SNAP-III, a thermoelectric generator that utilized the heat from the radioisotope polonium-210. This grapefruit-shaped device weighed four pounds and had an initial power output of about 3.5 electrical watts; it was still producing measurable power a year later. Martin Company's Nuclear Division built this proof-of-principle device for the AEC, using thermoelectric materials supplied by Minnesota Mining and Man-

ufacturing. Polonium-210 is a man-made radioisotope; it was obtained from the Mound Laboratory, which is operated for the AEC by Monsanto Chemical.

The natural decay rate of a radioisotope, termed its half-life, determines in major part the operating lifetime of a radioisotopic power plant. For example, polonium-210 has a half-life of about 140 days. In other words, the output of a 3-watt radioisotopic power unit using polonium-210 would be about 1½ watts at the end of a 140-day period. It would be one-half of that amount at the end of another half-life, or 140 days, and so on.)

A larger version of the SNAP-III is the SNAP-1A, also being built by Martin. It uses cerium-144 as the radioisotopic "fuel." This radioisotope has a half-life of 285 days. More important, it is a product of the fission process and so might be obtained from the waste product of a fission reactor. The SNAP-1A weighs 175 pounds and is designed for a power output of 125 electrical watts, 28 volts d.c. Design and construction of the radioisotopic power sources for use in other than the SNAP program is going on at Martin and other companies.

Early this year, Westinghouse announced it had developed for the Air Force a 40-pound power supply for such uses as small unmanned surface radio beacons and weather stations. Ten inches high and 16 inches in diameter, this generator produces approximately 150 electrical watts and was designed for one year of continuous unattended operation. It is designed to use such radioactive isotopes as curium-242 as the heat source. The generator's 144 semiconductive elements are heated by the heat source to a temperature of about 1000° F. Finned heat exchangers, resembling quills on a porcupine, keep the ends of the thermoelectric couples at a temperature of 300° F.

At the present time, the feasible maximum power of radioisotopic power sources appears to be limited to about 500 watts. The SNAP program, however, includes units of larger capacities, which are intended to use lightweight nuclear reactors as heat sources.

### **Nuclear Power Plants**

Atoms International is developing four nuclear power plants of this nature for the AEC. They include the SNAP-10A, a 500-watt power unit; SNAP-2, a 3000-watt unit; and SNAP-8, units producing 30,000 to 60,000 watts—all intended for use in

interplanetary space. For surface and underseas applications, there is the SNAP-4, with a power range of one to three megawatts! Westinghouse has constructed an experimental thermoelectric generator, similar in nature to the five-kilowatt unit developed for the Navy, for use with the SNAP-10A reactor.

These units are, of course, still in the test stage. In February 1961, however, Dr. Chauncey Starr, president of Atomics International, was able to report to the Joint Congressional Committee on Atomic Energy that the first operating reactor in this program had completed a year of testing, during which it generated 225,000 kilowatt-hours of heat, the equivalent of full-time operation at design power for a half-year.

For other than space applications, the Navy is optimistic about the feasibility of a ship propulsion system that would utilize a nuclear reactor and thermoelectric generator combination.

### **Plasma Cell**

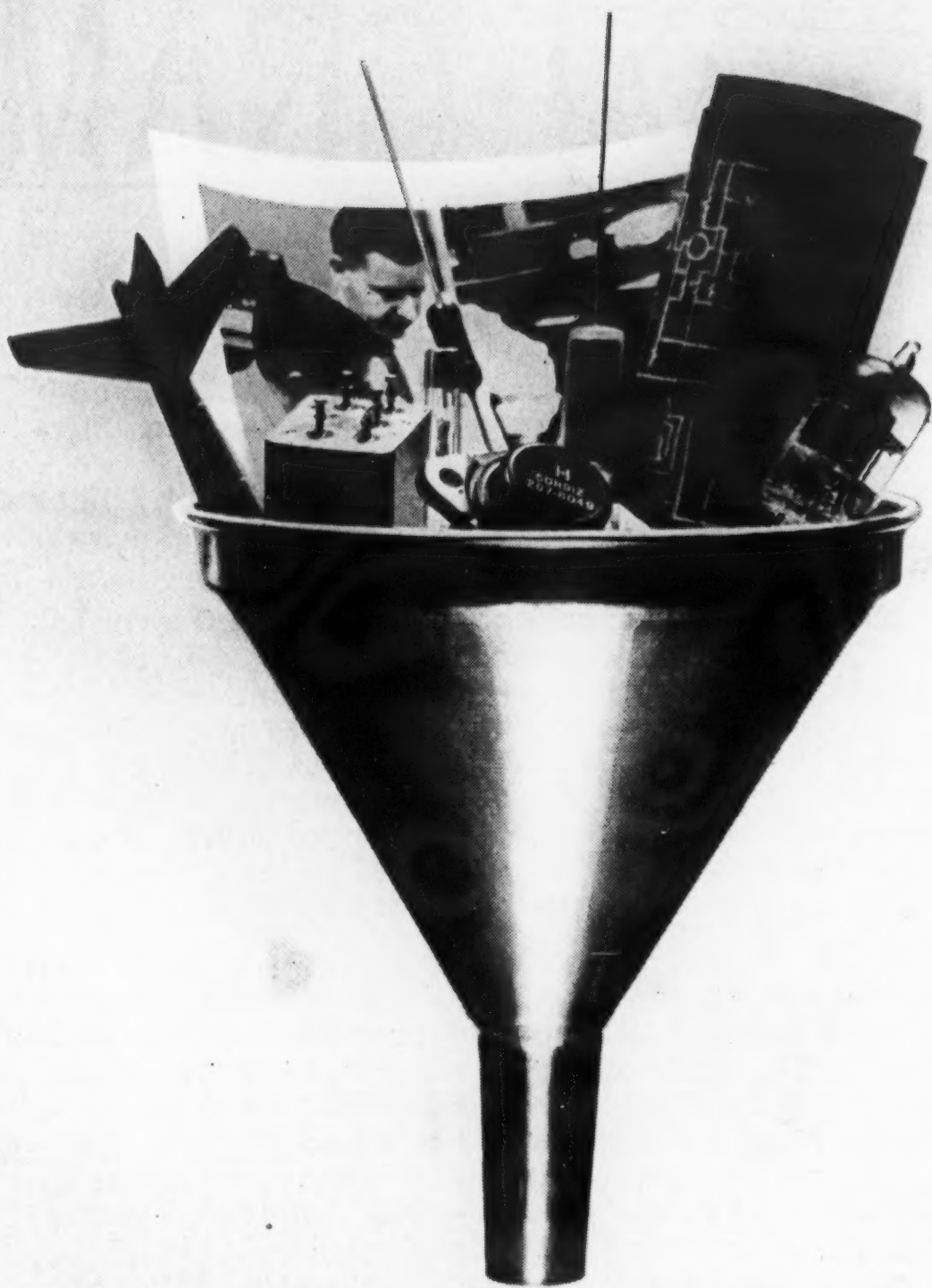
Thermionic converters, too, are promising users of nuclear energy as heat sources. Most intriguing, as well as simplest of the schemes being worked on today, is the plasma cell, or gas thermocouple, as it is also called.

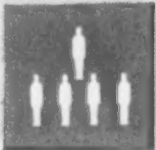
This is a variation of the thermionic diode previously mentioned in which cesium gas was introduced to counteract the space charge. In the plasma cell, the uranium fuel rod needed for the reactor operation acts as the cathode and the container for the fuel erod acts as the anode. The fission process heats the fuel rod to incandescence and the cell generates electricity. Both General Electric and the Los Alamos Scientific Laboratory are working on this concept.

Although this is a simple device, there are many problems including the by-now familiar one of high temperature materials technology, optimizing the conversion efficiency and many others that first require solution.

Problems of this type serve as stimulus to the creative minds of research and development scientists and engineers. Certain it is that direct conversion is well-established as one of the newest technologies. It is also certain that accomplishments in direct conversion devices for the Nation's military and space programs will inevitably lead to peaceful applications for industry and the home—for this is the history of military research and development.





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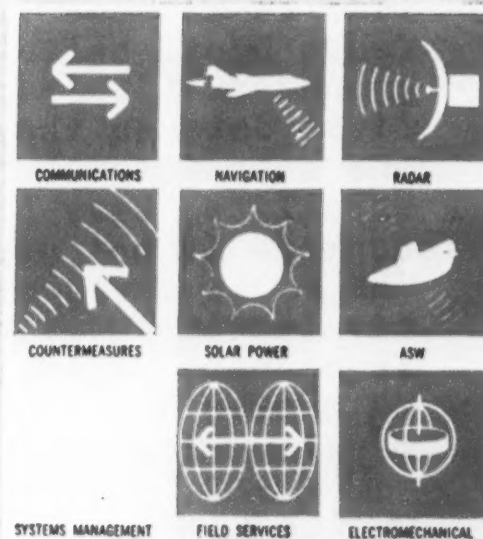
**ULD-1  
480-L  
DCCS**

In 1957, in conjunction with the U. S. Air Force, Hoffman implemented the idea of a co-contractor, systems management team relationship for the ULD-1 Program. This involves the development of a system by many co-contractors under the guidance and direction of the Hoffman Systems Management Department. Basic experience in such cooperative efforts was acquired by Hoffman's management of the team producing the Air Force's ULD-1 (Tall Tom) System. The ability to integrate its contributions with those of other organizations is demonstrated by Hoffman's participation as a team member in projects 480-L (AIRCOM), the Air Force's World-Wide Communications System and DCCS, DCA's Defense Communications Control System.

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—GOVERNMENT—

PROPOSALS FOR NORAD AUTOMATED COMBAT OPERATIONS CENTER have been invited from 17 firms by the Electronic Systems Division of the Air Force Systems Command. The proposals will lead to a development-production contract for the North American Air Defense Command Center, which will be located near Colorado Springs, Colo. Scheduled to be opened June 1, proposals were solicited from Aeronutronic, Bendix, Burroughs, General Dynamics, General Electric, General Telephone & Electronics, Hughes, International Business Machines, International Telephone & Telegraph, Lockheed, Martin, Philco, Raytheon, Radio Corporation of America, Sperry Rand, Thompson Ramo Wooldridge and Western Electric.

AF OFFICE OF SCIENTIFIC RESEARCH has awarded \$2.4 million in contracts and grants for basic scientific research during the nine-week period ending May 4. The Air Force awarded seventeen new contracts and negotiated twenty-nine continuing or renewal contracts, plus thirteen grants for scientific research in universities, non-profit institutions and industrial laboratories. The Office of Scientific Research is the major research contracting agency of the Office of Aerospace Research, formerly the Air Force Research Division of the Air Research and Development Command. On April 1, the Office of Aerospace Research was detached from the new Air Force Systems Command and now reports directly to the Chief of Staff, USAF.

POLARIS ITEMS OF INTEREST: Representatives of 24 subcontracting firms met last month for a "reliability conference." The meeting was a continuation of industry-Navy efforts to familiarize Lockheed Missiles and Space Div., prime contractor for Polaris missile system, and the subcontractors with each other's reliability programs and to insure mutual understanding of concepts, definitions and other program requirements ... An FBM submarine of the Lafayette class has been named Andrew Jackson. Keel-laying ceremony was held April 25 ... The following Polaris contracts have been awarded by the Navy recently: submarine automatic maneuvering control systems, Bendix Corp., \$1 million; MARK I inertial guidance systems, General Electric Co., Ordnance Dept., \$4.5 million; submarine communications systems, Sylvania Electric Products, Inc., \$5 million; submarine inertial navigation equipment, Sperry Gyroscope Co., Marine Div., \$8.5 million and North American Aviation, Inc., Autonetics Div., \$2 million.

U. S. INTELLIGENCE OPERATIONS will be studied by the Foreign Intelligence Advisory Board which President Kennedy re-established last month. Organized in 1956 by former President Eisenhower, the special advisory group was disbanded last January when its members offered their resignations to the Kennedy administration. Dr. James R. Killian, Jr., who served as the first chairman of the group, will head the new group. Chairman of the Massachusetts Institute of Technology, Dr. Killian served as science advisor to Eisenhower. Other members of the group include Gen. Maxwell Taylor, former Army Chief of Staff; Robert D. Murphy, former Undersecretary of State and now president of Corning Glass International; Dr. William L. Langer, professor of history at Harvard University; Lt. Gen. James H. Doolittle, chairman of the board of Space Technology Laboratories, Inc., and Dr. William O. Baker, vice president for research for the Bell Telephone Laboratories.

NRL'S LOFTI SATELLITE opened a whole new field of scientific investigation that may lead to advances in military communications and space vehicle navigation, the Defense Dept. believes. By receiving VLF (Very Low Frequency) radio signals from a ground station, the Naval Research Laboratory satellite provided science with its first data on the degree of VLF penetration into and through the ionosphere. From the data telemetered back to earth from the LOFTI (Low Frequency Trans-ionospheric) satellite, Navy scientists have been able to confirm their belief that the ionosphere is not nearly as opaque at these frequencies as generally assumed and that VLF radio waves do pass through the ionosphere into the exosphere with relatively little attenuation. It has thus been definitely demonstrated that while the ionosphere reflects VLF radio waves back to earth to a large degree, it also permits very substantial penetration of VLF waves to outer space. The LOFTI vehicle was launched Feb. 21.

(Continued on page 20)





## ENEMY LACK OF RECONNAISSANCE "PROTECTS" THE ALLIES AT GALLIPOLI

Gallipoli was a test for reconnaissance.

In 1915 the Allies struck at Gallipoli, intending to pierce the vital Dardanelles passage, capture Constantinople, remove Turkey as an effective fighting force and buoy the flagging spirits of their Russian allies. But the Gallipoli landings ran afoul of entrenched masses of determined Turkish troops. The stalemate continued from April through December, 1915. Finally, the Allied high command decided to evacuate . . . quite a trick when opposing trenches were often only ten feet apart! If the Turkish army should have an inkling of the evacuation before completion—if one effective reconnaissance flight were to examine the Allies' disappearing strength, it would mean disaster . . . perhaps the loss of more than 80,000 Allied troops.

But, while Turkish pre-war planning carefully built a large army, the generals ignored the value of reconnais-

sance capability, thereby allowing an entire army to escape intact. Allied planes, such as the Sopwith Baby, scanned the skies for Turkish and German recon planes. But none flew out to watch the exodus. For five days troops and supplies were discreetly taken off until only 1500 Allied soldiers manned the lines against the entire Turkish army. And finally everyone had gone. Casualties: 2 wounded.

The spirit and fierce resistance of the Turkish army had been manacled by lack of reconnaissance, a costly oversight.

From the beginnings of communities on the face of the earth, reconnaissance has helped shape history. Today CAI's specialty in this area is helping shape history to the advantage of the Free World. Typical of CAI contributions are: **V.I.P.** Visual Integrated Presentation, data display system; **KA-30** the world's most versatile aerial camera; **SOLO** the only electro-optical "available now" guidance system.



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NASA SEVEN-STAGE ROCKET propelled an artificial meteor back into the earth's atmosphere at a speed of about 25,000 miles an hour, April 21. This is believed to have been the first seven-stage rocket to be launched, according to the National Aeronautics and Space Administration. The rocket, a Trailblazer 1 solid fuel vehicle, was carried 175 miles high by the first three stages. Near peak altitude the next four stages fired successively downward to permit the seventh-stage explosive accelerator to gunfire the meteor back into the earth's atmosphere. The experiment was conducted as part of a continuing study to determine the various problems associated with re-entry into the earth's atmosphere of satellites and space vehicles.

STANDARD PLANNING PROCEDURES have been adopted for use in curtailing activities at Department of Defense installations. Concerned with the problems in personnel and community relations which follow a decision to curtail or inactivate an installation, Secretary of Defense Robert S. McNamara established an Installations and Relocation Planning Committee on March 31, and assigned the committee the task of preparing a standard planning procedure. The procedure calls for the development of factual data relating to the reasons for the decision to discontinue or curtail the particular activity, the impact of the decision on the community, and possible future use by other government or commercial interests of the facilities.

USNS ELTANIN, an ice-strengthened cargo ship, will become a seagoing scientific laboratory of the U. S. Antarctic Research Program under the terms of an agreement announced by the National Science Foundation and the Military Sea Transportation Service. The ship will be fitted to accommodate numerous disciplines, including meteorology, upper atmosphere studies, marine and terrestrial biology, physical oceanography, submarine geology and geomagnetic studies. The first research cruise is tentatively scheduled for the end of 1961. Cost of the ship conversion will be principally borne by NSF. MSTC will award the conversion contract and supervise the ship's modification.

ATOMIC CLOCK has been developed for the Air Force by the National Co., Inc., Malden, Mass. The airborne device, said to be so accurate that its maximum error would not exceed one second in 1,271 years, should become operational for use as a frequency standard in Air Force missiles and aircraft next year. The 62-pound device will replace the numerous crystal oscillators now required to calibrate airborne communications, navigation, guidance, fire control, computers and timing devices.

#### — INDUSTRY —

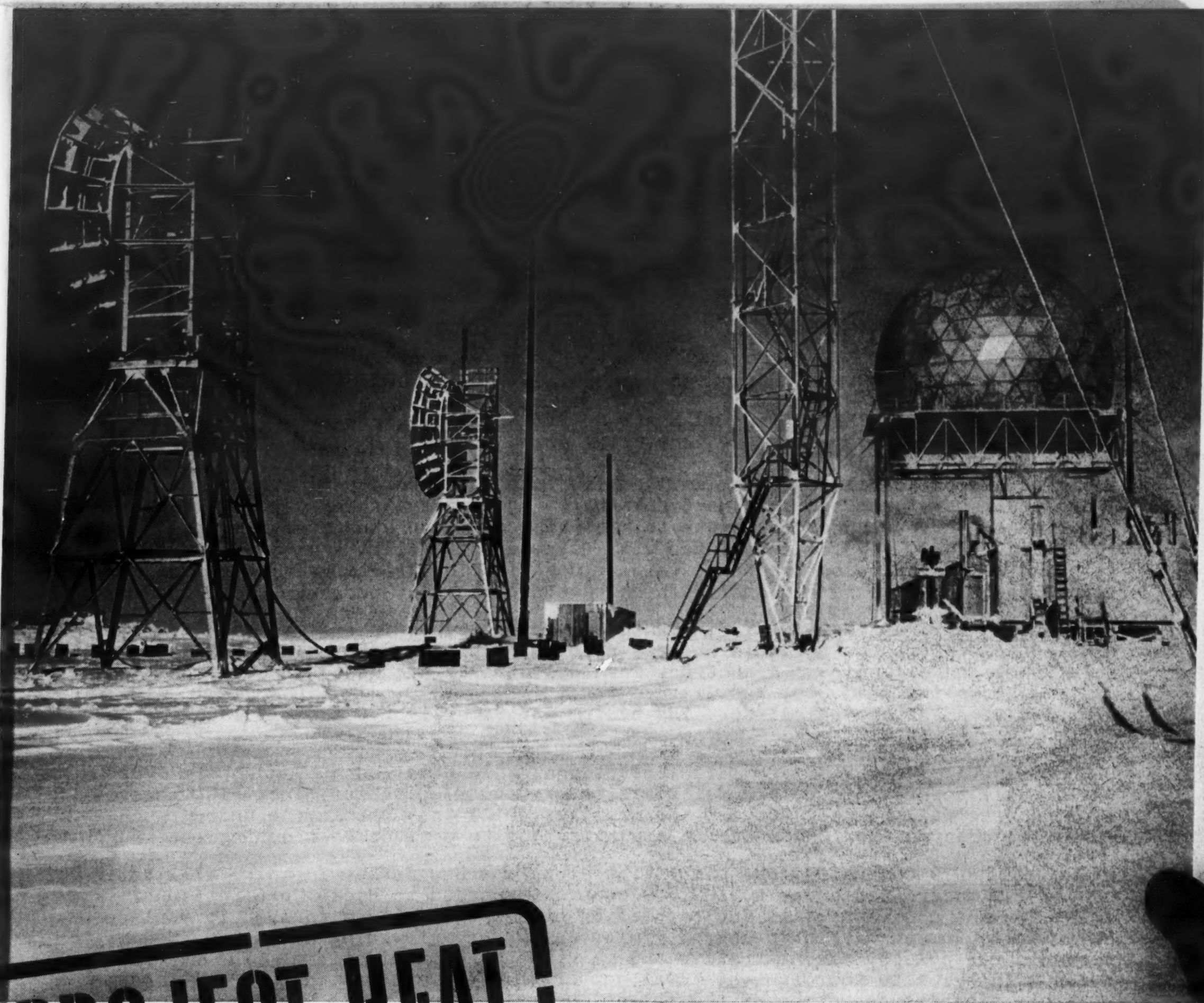
ITT INVESTMENT IN SOUTH AMERICA may reach a quarter of a billion dollars "during the next five years" if the United States government establishes guarantees against losses resulting from political action, according to Harold S. Geneen, president of International Telephone & Telegraph Corp. At a recent press conference Mr. Geneen stated that the cost of making good on the "few investments that might be lost" under such a program "is insignificant compared with the cost of outright foreign aid." Such political guarantee would create "a climate for investment" and would "not involve any major government outlays," he said.

PORTABLE "COMMAND CENTER" that can be plugged into the bridge of a submarine by a commander when the ship surfaces is being manufactured by Bendix Corp., Scintilla Div. The unit is about the size of a portable typewriter case and contains all of the instruments needed for the commander's information and communications while on the bridge. It was designed to replace "a number of instruments" permanently installed on the bridge of submarines, Bendix reports. Developed by the Portsmouth Naval Shipyard, the command package has a simple, plug-in connection with a single hull penetration. It is stowed below decks when the ship is submerged and cannot fail due to flooding or pressure, it is said.

CHANCE VOUGHT CORP., Electronics Div., has opened a \$3.5 million facility in the Dallas-Fort Worth region of Texas. The new plant has all the units necessary for the operation of an autonomous electronics organization—engineering and manufacturing facilities, five laboratories, administrative, marketing, quality control and finance offices. Included in the laboratory complex are computer, servomechanism, fluids, microwave and environmental test facilities.

RFI PROBLEMS will be studied by the Armour Research Foundation under a \$2 million contract awarded by the Air Force Systems Command. The Illinois research firm will provide technical support for the tri-service program established by the Defense Dept. to examine for possible mutual interference all military electronic devices. ARF electronics and mathematics specialists will develop methods for analyzing the interference problem through the newly-established Electromagnetic Compatibility Analysis Facility at Annapolis, Md.





# PROJECT HEAT

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NEW COMPANY specializing in digital electronics has been formed in Minneapolis, Minn. Advanced Scientific Instruments will develop advanced digital and analog computing instruments and components, and special purpose electronic computing and control systems for business, industrial and military application.

INFORMATION HANDLING SERVICES, INC. conducts a product data storage and retrieval program designed for use by aerospace and electronics firms. Called VSMF, the Microfilm Catalog File contains a copyrighted, cross-referenced index which permits the user to locate a product easily. The VSMF system incorporates more than 70,000 pages of vendor product information from more than 1800 suppliers. Information Handling Services, Inc. receives product data from companies; indexes, codes and films the data, and then forwards the material to the firms using the VSMF system. A new firm, Information Handling Services, Inc. was formerly the Technical Services Division of Rogers Publishing Co. The independent company is located in Denver, Colo. at the same site previously occupied by Technical Services.

MANUFACTURER'S REPRESENTATIVES FOR SMALL BUSINESS FIRMS, Harry A. Persson Associates is procuring government and industrial prime and subcontracts for its clients in the New England-New York area. Working in this specialized field, Persson Associates expect to fill a gap in small business procurement contracting, and believe their services should be most helpful to those firms which do not always have the time or the personnel to devote to obtaining prime or subcontract work. Located in Oxford, Mass., Persson Associates will represent its clients at procurement centers and before prime contractors, help to negotiate contracts, advise in the administration of contracts, and assist in sales promotion, the company says.

SPECIALIZED OPTICAL TRACKING INSTRUMENTS and auxiliary equipment are being installed to support the nation's stepped-up missile program at the White Sands Missile Range in New Mexico. A contract for 18 Contraves high speed photographing systems, totaling \$940,000, was awarded to J. W. Fecker, Inc. of Pittsburgh, Pa., a division of American Optical Co. The system is primarily for missile launch coverage.

CLOSED CIRCUIT TV SYSTEMS FOR TITAN operational silo missiles at Vandenberg AFB, Calif. will be provided by Kin Tel Division of Cohu Electronics, Inc. The television cameras will be used to view the missiles while they are in the underground areas, to observe the ICBM's during elevation and to monitor them during the launch.

MICROWAVE RADIO COMMUNICATIONS facilities along the New Jersey Turnpike will be expanded and modernized under a \$188,000 contract awarded to Radio Corporation of America. The contract calls for completion of a program begun in 1956 to replace existing equipment with high capacity microwave gear, providing up to 120 channel circuits for police, administrative and maintenance communications. The new facilities will bring to thirteen the total number of microwave stations and will make possible separate operation of the police and maintenance radio systems and the remote control of road weather warning signs.

TEACHING MACHINES will be developed, produced and marketed by Prentice-Hall, Inc. and Litton Industries, under a joint agreement signed recently. Prentice-Hall, educational textbook publisher, will develop programmed educational materials for use with teaching machine devices. An electronics firm, Litton Industries will design and build teaching machines whose cost and performance are optimized for the educational materials and the user intended. The marketing program will be conducted jointly.

RADIO ENGINEERING LABS, subsidiary of Dynamics Corporation of America, has received a contract to build a powerful 10,000 watt FM transmitting system that will "bounce" telephone and teletype signals off an Echo-type satellite in a 2,000-mile experimental Air Force span between Floyd, N.Y. and Trinidad, West Indies Federation. Designed to provide the reliability and clear voice reception of wired telephone systems, the equipment is being built for Page Communications Engineers, Inc., which is responsible for the installation of communications equipment, under technical direction of the Rome (N. Y.) Air Development Center.

PHILCO TRANSISTOR RELIABILITY PROGRAM uses 100 per cent fail-safe, automatic life test equipment which precludes human and equipment errors that could be more numerous than actual transistor failures in a test run of several thousand units, the firm reports. Project Virtue, Philco's \$5 million reliability assurance program, has for its objective a composite transistor failure rate of only one failure in 100 million hours of use in a system. The company's transistors are presently providing a reliability rate of only one failure in 50 million hours of operation, it is said.

(Continued on page 28)



# NEW NAVY RADIO FACILITIES IN MAINE

## PART I

### VLF Station at Cutler

by

JAMES O. WELDON

President

Continental Electronics Manufacturing Company

## PART II

### Dedication of Fabbri Hall at Winter Harbor

SIGNAL Staff Report

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## PART I

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On 4 JANUARY 1961 a message was transmitted by the Navy's new high power Very Low Frequency station near Cutler, Maine, to VAdm. W. F. Raborn, RAdm. F. Virden, RAdm. R. K. James, and RAdm. D. J. Peltier, in conference at the Pentagon building. This message marked the substantial completion of construction at the site of this facility, which provides improved fleet communication for a large portion of the world, including Atlantic and Mediterranean areas. The completion was accomplished one year ahead of the originally scheduled date.

The prime contractor for transmitter manufacture, antenna and power plant design, and for construction at the site is Continental Electronics Manufacturing Company of Dallas, Texas, a subsidiary of Ling-Temco Electronics, Inc. The work was performed under Bureau of Ships contracts with the administration of the construction in charge of the Bureau of Yards and Docks through the Officer in Charge of Construction, First Naval District, Boston. Including all subcontractor personnel, there were periods when over 1400 persons were at work at the site.

#### *Award of Merit*

Continental Electronics received the Award of Merit from the National Safety Council for its low accident rate and no accident death occurred during the construction period although much of the work was of a hazardous nature performed in adverse weather conditions.

The Navy staff and contractors were congratulated by Vice Admiral Raborn, Head of Special Projects,

Rear Admiral James, Chief of the Bureau of Ships, and Rear Admiral Peltier, Chief of the Bureau of Yards and Docks, for meeting the expedited schedule.

The antenna construction required the pouring of 50,192 cubic yards of concrete for tower bases and anchors, the erection of 26 towers ranging from 800 to 980 feet in height and having a total weight of 8500 tons, the erection of 36 counterweight towers standing 195 feet high with a total weight of 5500 tons. The system of bronze cables held aloft by the towers resembles two 6-pointed stars, each formed by 6 diamond-shaped panels of 8 cables each. One end of each panel ties off at the 980-foot center tower of an array with the opposite point stretched 2800 feet to one of the 6 outer ring towers, each 800 feet high. At the panel centers support is provided by an inner ring of six 875-foot towers. Each of the two star-shaped arrays covers about one square mile of land.

A ground system covering about 4 square miles of land uses 11,000,000 feet of No. 6 AWG bare copper wire, buried at an average depth of one foot. In some areas the radial wires are spaced as close as 6 wires per degree of azimuth. There are 246 sea terminals, where Cupro Nickel cable is extended into the ocean to below low tide, at regular intervals around the three sides of the peninsula where the facility is located.

A 12,000 kilowatt diesel power plant forms a part of the facility. Normal power demand of the transmitter is a maximum of 3500 kilowatts but 10,000 kilowatts is required to de-ice one antenna array while the other is operated at

half power. A pier and petroleum off-loading facility was also constructed at the site.

The transmitter has an output power in excess of 2 million watts in the frequency range from 14 to 30 kilocycles. It is at least twice as powerful as any previously in use by the Navy or elsewhere in the world.

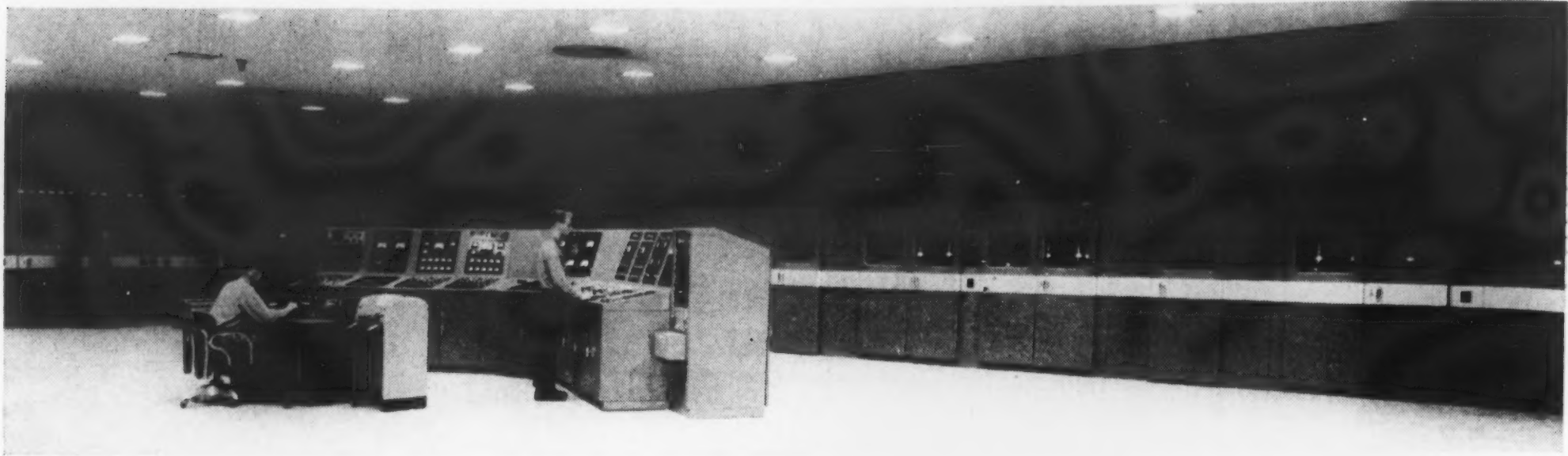
Four power amplifiers are combined to produce the output of in excess of 2,000,000 watts. An isolating system permits the removal of one or more power amplifiers from service by pushbutton control at the console. The amplifier may then be serviced, tested into a dummy antenna and returned to active operation. An untuned intermediate power amplifier (IPA) provides drive for all power amplifiers. This IPA is installed in duplicate, as are the frequency control and keying units located at each end of the central power control and tuning console.

#### *"On-Off"*

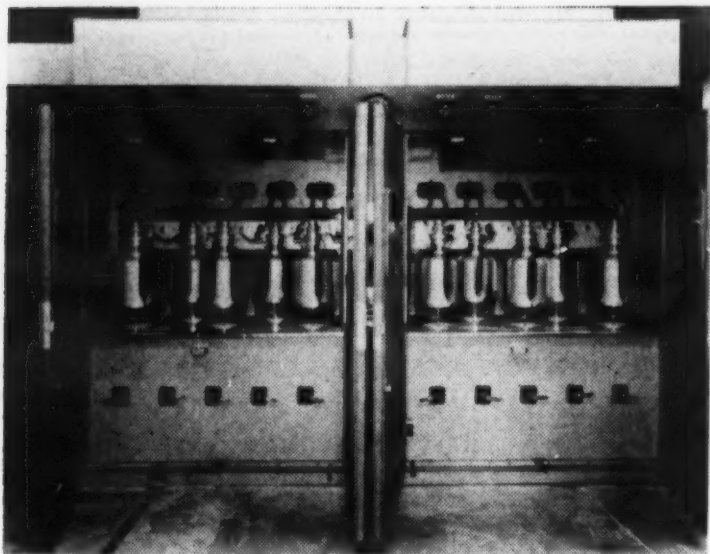
Both "ON-OFF" International Morse and 60-word-per-minute teletype frequency shift keying are provided.

The antenna efficiency now under measurement in connection with proof of performance testing is expected to exceed 50% which will result in the radiation of over one million watts of useful signal power. This is at least three times the useful radiated power of any existing VLF facility. The antenna Q, above 300 for the full antenna and higher for a single array, makes necessary the use of saturable reactor resonance keying to permit the frequency shift method of signalling.

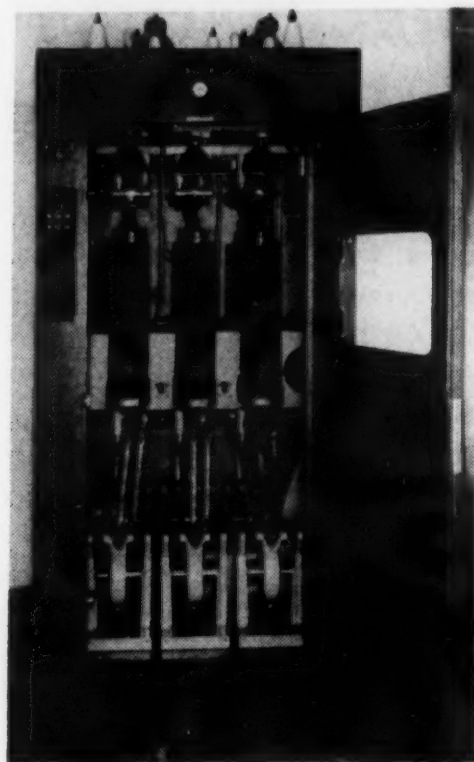




*The transmitter develops a continuous output power of over two million watts. Four Power Amplifiers on the right occupy a panel space of 72 feet. One of the duplicate Intermediate Amplifiers can be seen in the three cabinets at extreme left. Control console is in foreground.*



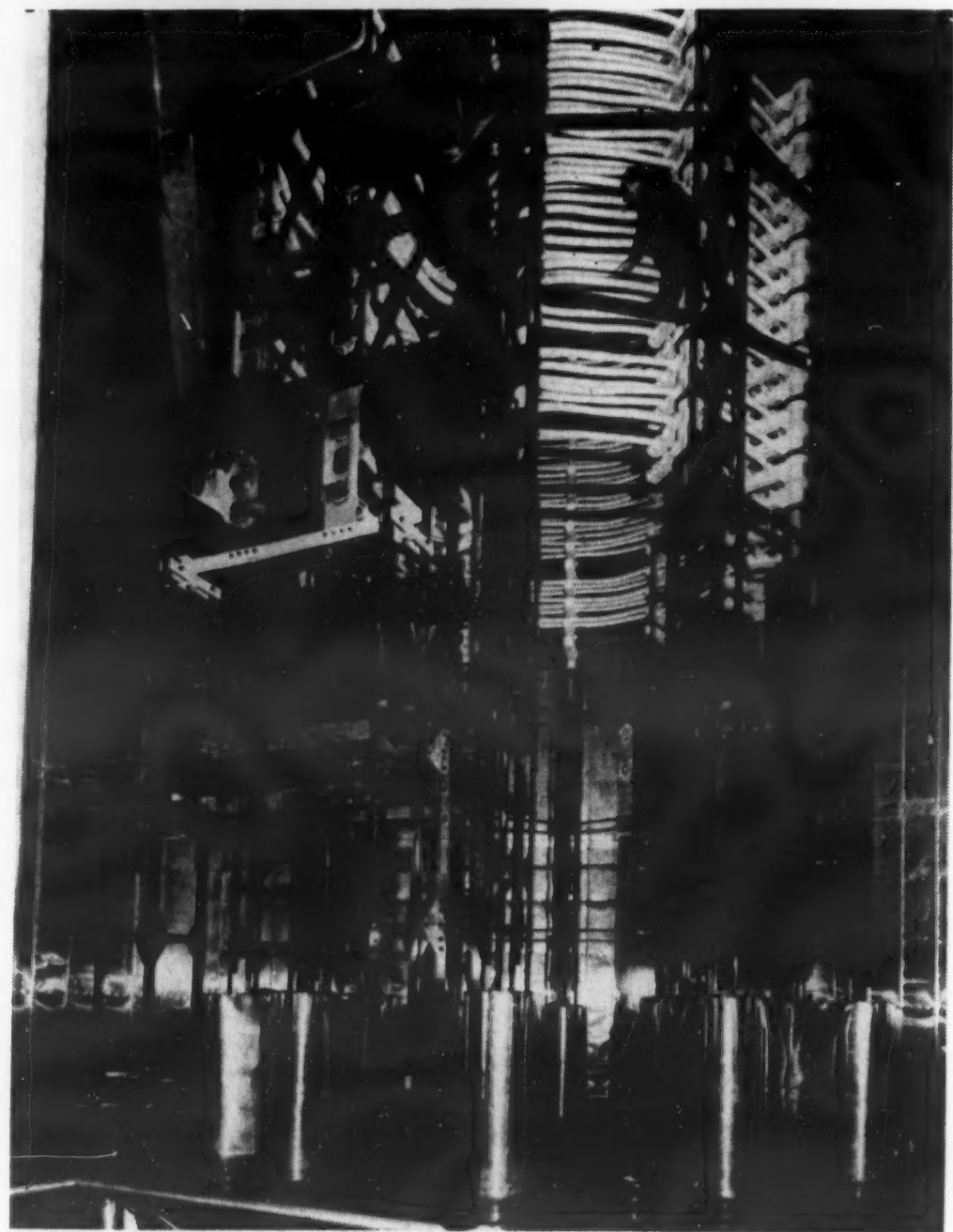
*Close-up of a single Power Amplifier shows ten Machlett Type ML-6697 air-cooled tubes, 8 active and 2 spare.*



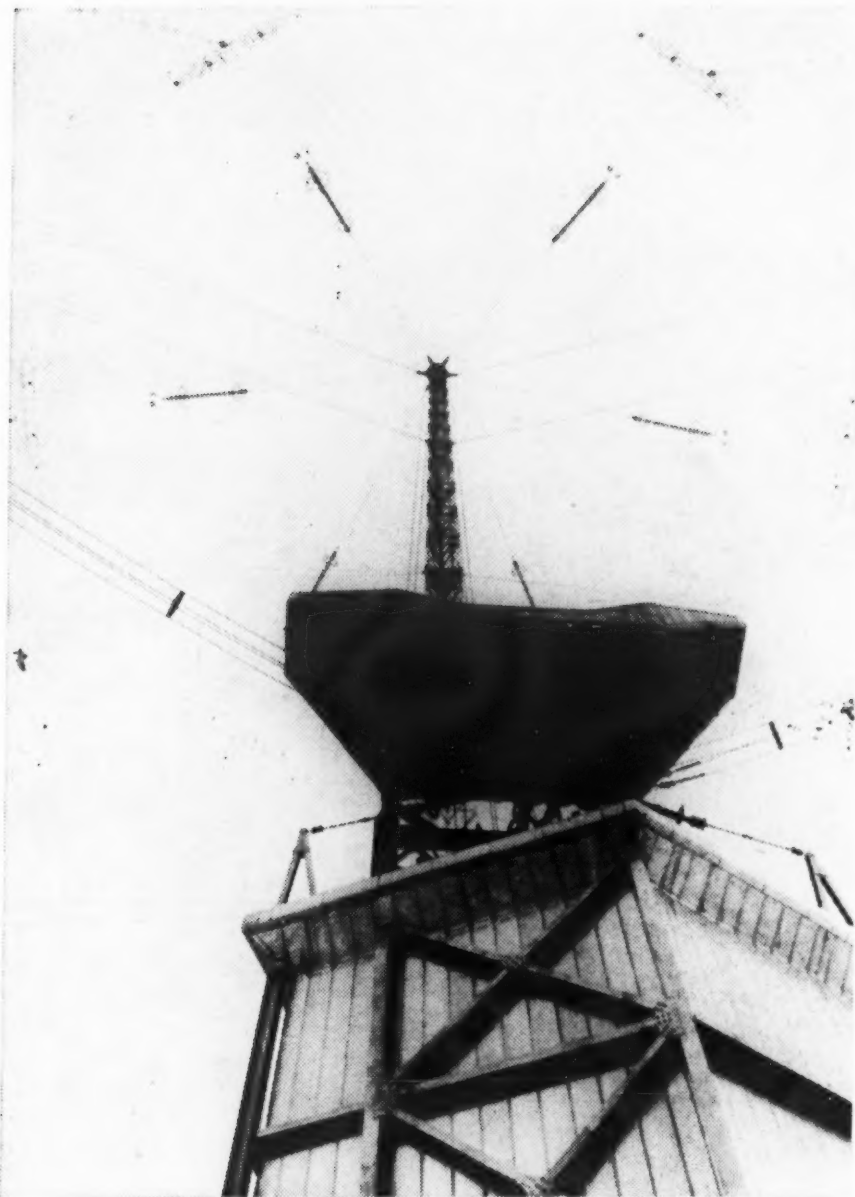
*Two of these 2400 kilowatt rectifiers supply up to 13 kilovolts for Power Amplifier DC plate Voltage.*

## Photos of VLF Station

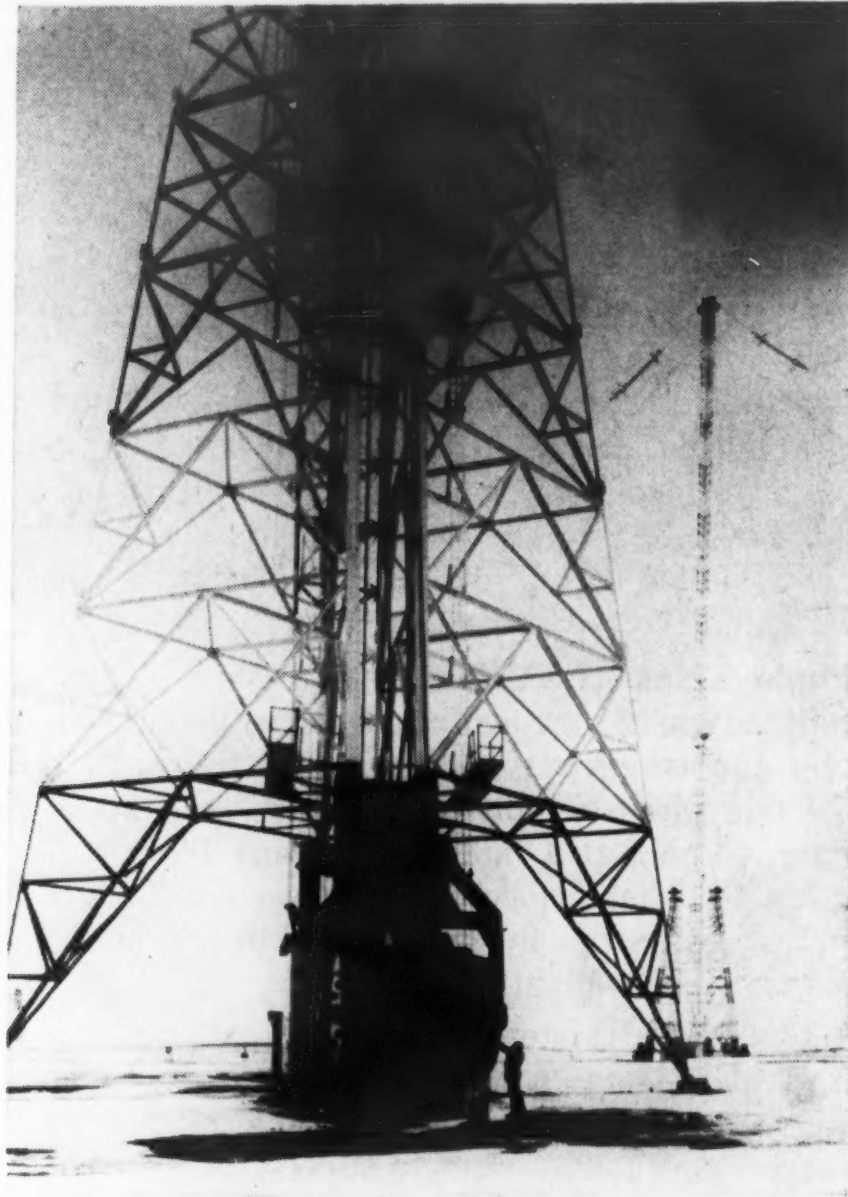
*To resonate the giant antenna, these forty-foot high helix coils wound with 3 parallel 3.4" diameter Litz cables are located in aluminum houses at each of two antenna feed points. Porcelain arms are supported by frame of "Permali" a phenolic with laminated wood base.*







Over 9-foot diameter sheaves, at the top of the center towers,  $2\frac{3}{4}$ " steel halyards stretch in six directions to connect with 75-foot long strain insulators which hold the inner points of six diamond-shaped panels of bronze cables. These form one of the two arrays of the antenna system. Stainless steel trusses over 100 feet long, swung under each panel of cables, support down-leads formed of four one-inch copper cables in a 3-foot diameter cage configuration.



The 799-foot "outer" circle towers have a single counterweight tower, counterweight and hoist. Each of the 36 counterweight drums in the system weighs 406,000 pounds, and with the four-way halyard reaving pulls its corner of the antenna panel to a tension of 100,000 pounds. With ice loading on the antenna the counterweight can travel up the track of the tower to nearly 200 feet, paying out four times this length in halyard cable to lay the panel on the ground and prevent failure.

## PART II

SOME 45 miles down the Atlantic Coast from the Cutler station is the U. S. Naval Security Group Activity at Winter Harbor, Maine. Here dedication ceremonies for a new enlisted barracks to be called Fabbri Hall were held March 25. This barracks is named in honor of Navy radioman, Lt. Alessandro Fabbri, U. S. Naval Reserve Forces, who in the early ham radio days before World War I started a small experimental amateur radio station which provided radio reception along the New England coast. During World War I, Fabbri turned the station over to the Government and was commissioned an ensign and given the job of first officer-in-charge of the station.

Commander C. G. Lawrence, USN, Commanding Officer at the U. S. Naval Security Group Activity, recounted the activities of this station in dedicating Fabbri Hall: "During its heyday the station handled traffic from Europe and from ships at sea between here and Europe at a rate that was in those days unheard of, amounting to some 127 thousand

ship/shore messages during one 14 month period. It was involved in communications during such history-making events as receiving the first German surrender offer at the end of World War I; reception of the first trans-Atlantic photofax, which consisted of written greetings from General Pershing, from Paris, transmitted from the Eiffel Tower. The station communicated with the famous Navy NC flying boats in their 1919 flight across the Atlantic, and during the trans-Atlantic flight of the British dirigible R34 in 1919."

### Awarded Navy Cross

As a result of his accomplishments, Lt. Fabbri was awarded the Navy Cross in 1920, with a citation reading: "For exceptionally meritorious service in a duty of great responsibility in the development of the radio receiving station at Otter Cliffs, Maine, and the small sending station Seawall. Under Lt. Fabbri's direction, the station was developed from a small amateur experimental station, until at the end of the war, it was the

most important and the most efficient station in the world."

During World War I, the station at Otter Cliffs had approximately 80 watch-standing radio operators, plus about a hundred supporting personnel. After the war the station decreased in size and served as a small Coastal Direction Finder Station. In 1935 the station was moved to its present site at Winter Harbor and it now has approximately the same number of crew members as during World War I.

There are several AFCEA members who were radiomen at Lt. Fabbri's station. Those communicators present for the dedication ceremonies included Commander C. G. Lawrence, Ray E. Meyers, Lawrence Dutton, Charles Ellsworth and Harold Castner. Mr. Meyers, AFCEA Region F Vice President, was in charge of the ship/shore activity at the station. Mr. Castner, who has recounted many of his experiences as an amateur radio operator for SIGNAL, was among those instrumental in getting the barracks dedicated to Lt. Fabbri.



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**Day/Night Photographic System (F-426)** . . . one versatile camera system for the entire reconnaissance job. The F-426 is the first 9x9 inch production system capable of high and low altitude photography on both day or night missions. Systems of this type are being delivered to the Royal Swedish Air Force.

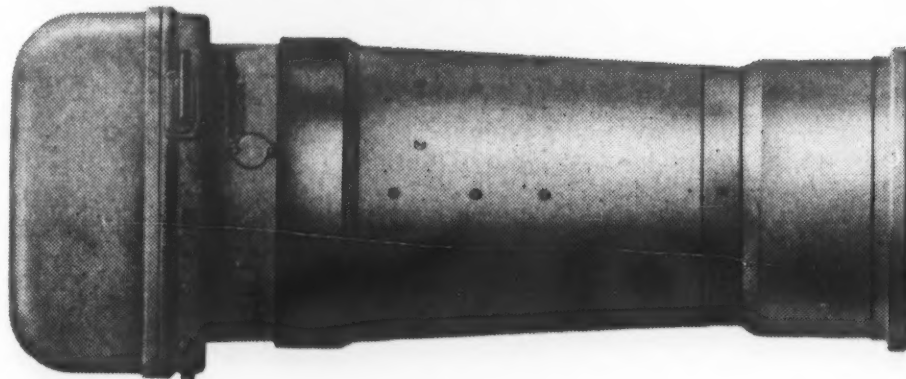
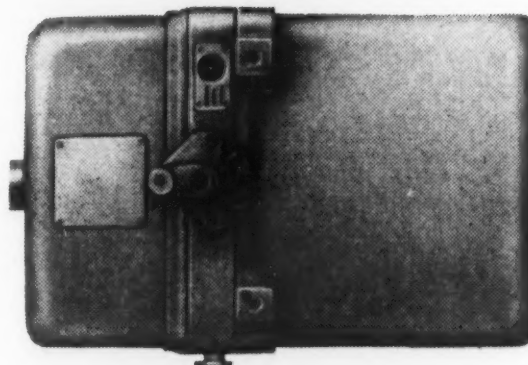
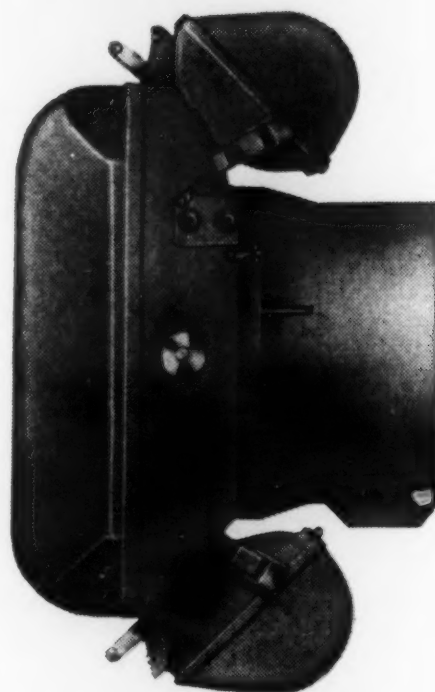
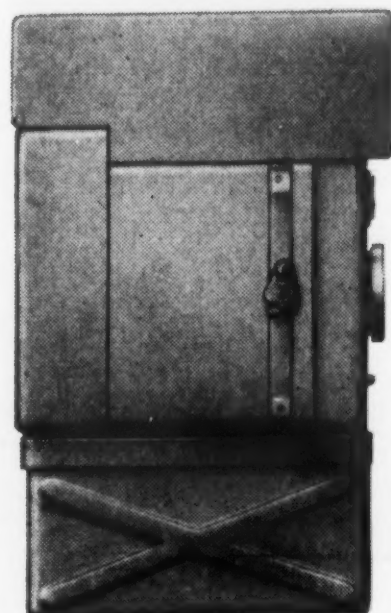
Fairchild has also developed high resolution, panoramic systems with scanning angles up to 180°. They replace the conventional array of long focal length cameras with a single package, reduce system size and weight, improve reliability and minimize production costs.

Only Fairchild, with 40 years of experience in electronics, optics, film processing and precision mechanism, offers this degree of *total reconnaissance capability*. For further information, write the Director of Marketing, Defense Products Division.



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— GENERAL —

DATA ON INDUSTRIAL ELECTRONIC EQUIPMENT SALES will be compiled under a new program established by the Industrial Electronics Marketing Data Committee of the Electronic Industries Association. Manufacturers participating in the program will submit dollar sales figures on important industrial products grouped under the following major sectors of the industrial electronics market: testing and measuring equipment; computing and processing equipment; control and processing equipment; communications and navigational aids; and miscellaneous equipment. With the exception of the first report, which will cover 1960, reports will be compiled and disseminated to reporting companies quarterly.

EFFECTS OF SPACE CONDITIONS ON SEMICONDUCTOR MATERIALS will be studied by CBS Laboratories, a division of Columbia Broadcasting System, Inc., at its Research Center in Stamford, Conn. Under an Air Force contract CBS will build a facility for simulating outer space conditions and will test semiconductors to determine which ones should be used in various space applications.

CHINESE COMMUNIST SCIENCE AND TECHNOLOGY DATA is contained in a selective bibliography available from the Office of Technical Services of the Business and Defense Services Administration, Commerce Dept. Entitled "Chinese Mainland Science and Technology," this bibliography lists U. S. government research reports and translations of foreign technical literature on scientific developments in Communist China and the effect of research and development activities on the population. Articles, professional papers and other literature listed cover the period from 1946 to late 1960. The bibliography may be purchased from OTS for ten cents.

USSR CODING SYSTEM developed by Soviet engineers in 1955 is discussed in an article translated from a compilation of Russian electronics literature now available in English through the Office of Technical Services, Business and Defense Services Administration, Commerce Dept. The system is "the most powerful and promising method of automatic programming" yet devised, according to V. A. Fedoseyev, author of the article, "Automatic Coding Systems for Computers."

FLEXIBLE BLANKET OF WATER which can protect man and equipment against the searing temperatures of space vehicle re-entries has been developed by scientists of the Astronautics Division of Chance Vought. The material is called "Thermosorb." It is composed of more than 90 per cent water yet has the handling characteristics of a solid. Placed between the inner and outer walls of a space craft, Thermosorb can hold the inside temperature of the vehicle well within human tolerance limits while the temperature of the outside skin may be as high as 4,000 degrees Fahrenheit, it is believed. The new material has been used successfully in rockets to protect instruments and control system components located in compartments immediately adjacent to rocket motor nozzles.

MEDICAL ELECTRONICS NEWS is a new quarterly publication containing information on instruments, methods and developments in the field of instrumentation and electronics. With 25,000 circulation, the publication is designed for doctors and technicians who are active in clinic and hospital research, medical and biological research institutes, medical schools and public health research laboratories. The quarterly is published by Instruments Publishing Co., Inc., 845 Ridge Ave., Pittsburgh, Pa.

INDUSTRIAL DEVELOPMENT SITE called North Electronics Park has been established by North Electric Co. of Galion, Ohio. Located near Galion, the 100-acre park is part of North Electric's program to support its community by encouraging new industries to locate in the area, the company says.

COMINGS EVENTS:

JUNE 14-15: Annual Conference of Professional Group on Product Engineering and Production, sponsored by Institute of Radio Engineers, Hotel Sheraton, Phila.

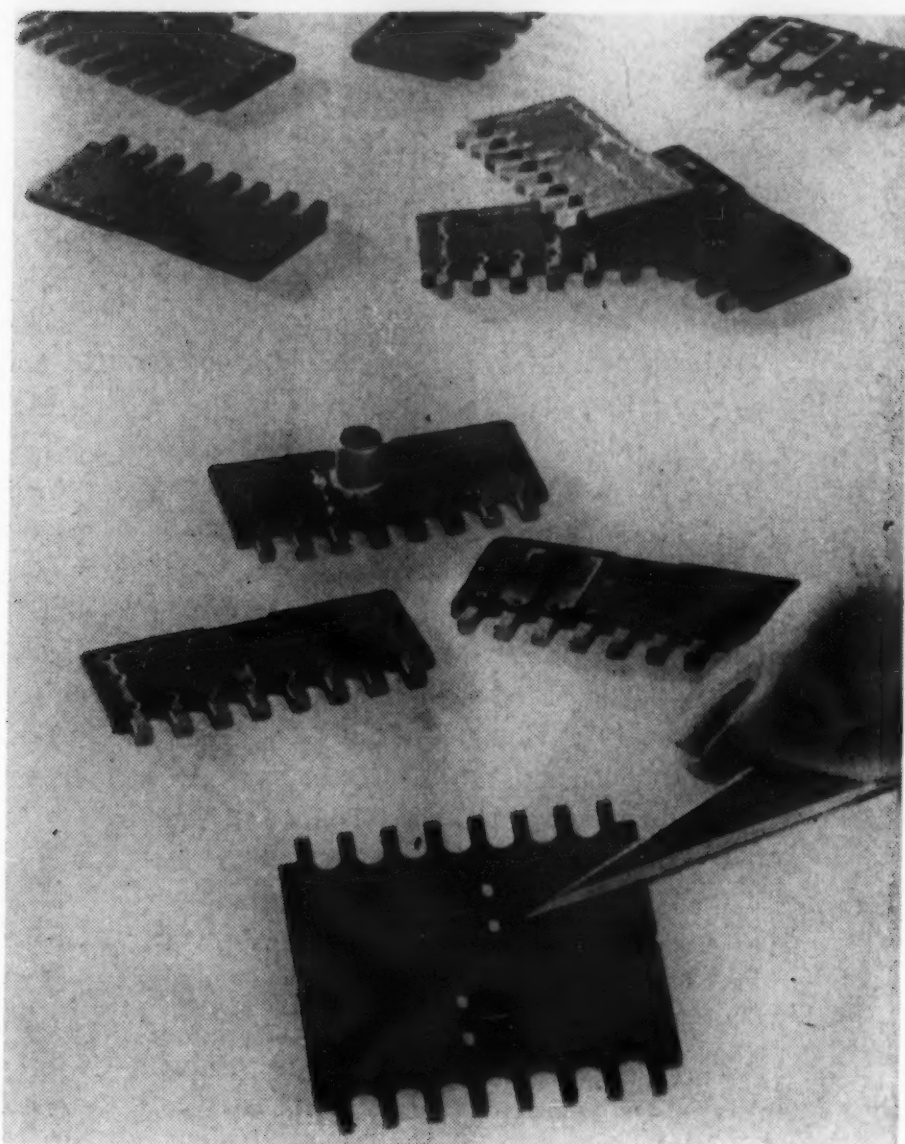
JUNE 25-30: Annual Meeting of American Society for Testing Materials, Chalfonte-Haddon Hall, Atlantic City.

JUNE 26-28: National Convention on Military Electronics, sponsored by Institute of Radio Engineers, Shoreham Hotel, Washington, D. C.

JUNE 28-30: Joint Automatic Control Conference, sponsored by Instrument Society of America, American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers and Institute of Radio Engineers, University of Colorado, Boulder.



# PICTURE YOUR IDEA



Complete operating circuits are placed on thumb-sized Universal Micro-decks by CBS Electronics. Fotoceram wafers for the Micro-decks are produced by Corning Glass Works, using a photosensitive-chemical etching process to achieve the intricate patterns required. In foreground is a Fotoceram wafer that forms two Micro-deck blanks. Behind it at left is a Micro-deck with top-side metallizing and at right is one with bottom-side metallizing. A completed Micro-deck with transistor, diode and resistors is behind them. In background are additional wafers.

## IN GLASS

by  
NICHOLAS LAZAR

Senior Product Engineer, Corning Electronic Components, Corning Glass Works

WHEN AN ELECTRON tube manufacturer developed special tube types used by the military, he had to find internal components that would withstand severe vibration, G\* forces, temperature variations and other serious drags on performance. In the case of one component—tube spacers—an unconventional glass-ceramic material trademarked Fotoceram met the demand. This substance begins its history as a true glass, albeit a photosensitive and thus special glass. A proprietary schedule of treatment turns the glass into a hard, close-grained, glass-ceramic material.

Another manufacturer ordered Fotoceram printed circuit boards, then changed his mind about the hole pattern. His fickleness created no difficulty because the substance, being

\*G is a unit of measurement of acceleration as so many times the acceleration due to gravity.

photosensitive in its initial stages, is uniquely suited to design changes. New patterns—or any patterns, no matter how odd—are produced easily by altering the art work from which photo negatives are prepared.

A company working on microminiaturization laid down requirements for wafers that (1) would take metallizing extremely well, (2) were suitable for deposition and/or mounting of miniaturized components, and (3) were reproducible in large numbers. Once again, the man-made, glass-ceramic met requirements.

Many designers, working out ideas in printed circuitry, know Fotoceram as the substrate for copper-clad grid boards. Using etching resists, they tape or paint circuit runs on a board, then etch away the uncovered copper. In 15 minutes the board is ready for components. Best of all, resolderability of metallized Fotoceram per-

mits use of a board again and again.

### Fotoceram History

These interesting new applications are no less appealing than the history of this remarkable substance. Fotoceram is the progenitor of Pyrocera, the material that is equally useful in missile nose cones and freeze-cook-serve cooking utensils. Like Fotoceram, Pyrocera is first a true glass, is then converted into a glass-ceramic, has valued electrical properties, and exhibits rugged thermal and physical characteristics.

Purple glass in the sunlight generated the speculation that led to these substances. The beckoning question that intrigued curious researchers was this: Why does ordinary glass darken to a purple hue under exposure to strong sunlight? (Glass *does* darken, in time. Compare window panes of

(Continued on page 31)

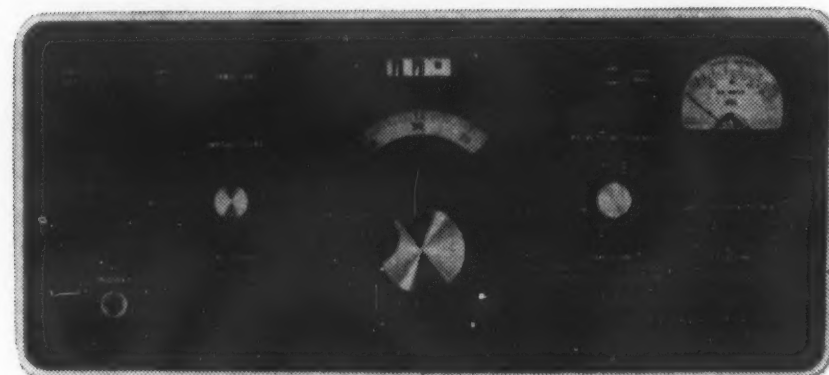


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original glass in a very old house with nearby, newer panes.)

The researchers' answer: Certain ingredients are sensitive to ultraviolet (UV) radiation.

Later came mastery of glass composition so that when an intense UV source was directed onto special glass through a photographic negative, a permanent, three-dimensional opal image was produced.

Thus, the Fotoform glass family of Corning Glass Works became a reality.

It was then found that in some types acid dissolved the image much more readily than the surrounding glass.

Thus was born a precise, accurate method of producing configurations in glass—even in the most minute, odd patterns. With this photographic-chemical machining process, Corning has produced glass screens with 562,500 holes per square inch, for use in storage and image orthicon tubes.

One day a young Corning scientist researching photosensitive glasses left a piece of Fotoform in a furnace that failed to shut down on schedule. Hours later he opened the furnace door expecting to see a shapeless, molten mass. Instead, he found the sample shape unchanged. But then he accidentally dropped it. Once again he was surprised. The dark brown piece did not break, but clattered on the floor with a solid, metallic clang.

Thus was born Fotoceram. By one of those fortuitous, stranger-than-

fiction circumstances that so titillate romanticists, the piece of Fotoform glass had been transformed into a crystalline, ceramic-like substance. Foresight and tenacity turned the accident into a major discovery, a significant mark in the parade of glass-ceramic development.

#### Process Variations

Several types of Fotoform are produced by process variations. Fotoform B is clear glass not exposed to ultraviolet light treatment. It is the type that remains after image etching is complete. Fotoform C is yellow-brown glass produced by heat treating Fotoform B. It is used sometimes without being etched because of its high electrical resistivity and opacity. Fotoform E is opaque, with color ranging from brown to black, depending upon treatment. When combined with Fotoform B it is useful for directional louvering, light chopper disks and substrates for electroluminescent devices.

Further heat treatment results in Fotoceram, which basically has electrical characteristics of Fotoform C but also possesses higher strength, higher melting point and higher thermal coefficient of linear expansion.

The first basic step in the photosensitive glass process is to reproduce the product desired in art work. Designs of hole and cut-out patterns are usually drawn on Mylar with India ink. Reproduction of art work in photographic negatives is then per-

formed with the best available materials and techniques. Often the art work is drawn several times larger than the finished products, then reduced in the working negatives to obtain the best possible accuracy.

In most cases, etching produces a hole with sidewall taper of about four degrees. One-side etching creates a conical hole. If etching is done from both sides, a hole with an hour-glass shape results. The taper allows smooth, continuous metallizing from the surface over the edge of the hole, important in printed circuitry. Size and shape of the hole are determined by art work and negative; square holes are about as easy to produce in Fotoform and Fotoceram as are squiggles.

#### Electronic Features

These are the chief features of Fotoceram in electronic applications.

(1) Patterns that would be impossible or extremely difficult to achieve by other glass working techniques can be achieved rapidly in this material.

(2) Softening point is above 700°C, making Fotoceram useful with a number of dependable metallizing techniques.

(3) At microwave frequencies, electrical characteristics are satisfactory over a wide thermal range. (See Table 1.)

(4) Deposition of break-free metallic films is made possible by Foto-

(Continued on page 54)

TABLE 1: Properties of Photosensitive Glass

Property		Fotoform		Fotoceram
		B	C	
MECHANICAL	Specific gravity	2.36	2.37	2.46
	Modulus of rupture, psi $\times 1000$ (Abraded samples)	>8.7	>16.0	>20.0
	Modulus of elasticity, psi $\times 10^6$	11.0	12.0	13.5
	Modulus of shear, psi $\times 10^6$	4.6	5.1	5.7
	Working tensile strength, psi $\times 1000$	1.0		3.0
	Knoop hardness, kg/sq mm (100 gm)	507	566	581
	Softening temperature, °C			700
	Specific heat, cal/gm-°C			
	at 25 C			0.209
	200 C			0.256
	Thermal conductivity, cal/sec-cm $2^\circ\text{C}$ per cm			
	at 25 C			0.0056
	200 C			0.0050
	Surface finish (as abraded), microinches			80-120
	Poisson's ratio	0.20	0.18	0.20
ELECTRICAL	Power factor, at 1 mc and 20 C	0.005	0.003	0.006
	1 mc and 200 C	0.130	0.021	0.014
	Dielectric constant, at 1 mc and 20 C	6.5	5.7	5.6
	1 mc and 200 C	8.3	6.3	6.3
	Dissipation factor, at 1 mc and 20 C			0.0062
	Loss factor, at 1 mc and 20 C	0.033	0.017	0.034
	Dielectric strength, volts/mil			>450
	Surface resistivity, ohms/sq			
	Untreated surface			>10 <sup>8</sup>
	Silicone-treated			>4 $\times 10^{12}$



## Price Is an Object

(Continued from page 11)

any job done by less expensive substitute means.

Another way to state this objective is to say that we are determined to give the military forces more equipment for the same amount of money. This we can and must do. This, in no manner of thinking, deters us from all-out effort to seek greater appropriations than we have received in the past.

### Need for Industry Views

We invite the views of Industry on cost—in all its aspects. We not only invite, but we *urge* all Research and Development contractors to carefully examine all specifications and military characteristics and point out to us any—which, in their opinion—will possibly cost more than their worth in the increased cost of the end products. During the last several months, we have received from contractors several suggestions of this kind which have been accepted.

This represents a marked change in attitude toward our Research and Development contracts. Heretofore, our technical specifications and the prescribed military characteristics have been quite rigid, and we generally discouraged any suggestions that they be modified. Now, we actively solicit suggestions as to features which may be too costly and from which we won't get our money's worth.

Our situation is comparable to that of General Lee who was constantly on the look-out for sharpshooters during the "War Between the States." His strategy was to place them along communication lines where they

could "pick-off" Union couriers carrying high-priority messages.

In a little village in Northern Virginia, he noticed several targets set up here and there around town and on each of these someone had scored a "bull's-eye."

When General Lee inquired as to who was responsible for this superb marksmanship, the village idiot was brought before him.

"How on earth do you do it, Son?" he asked.

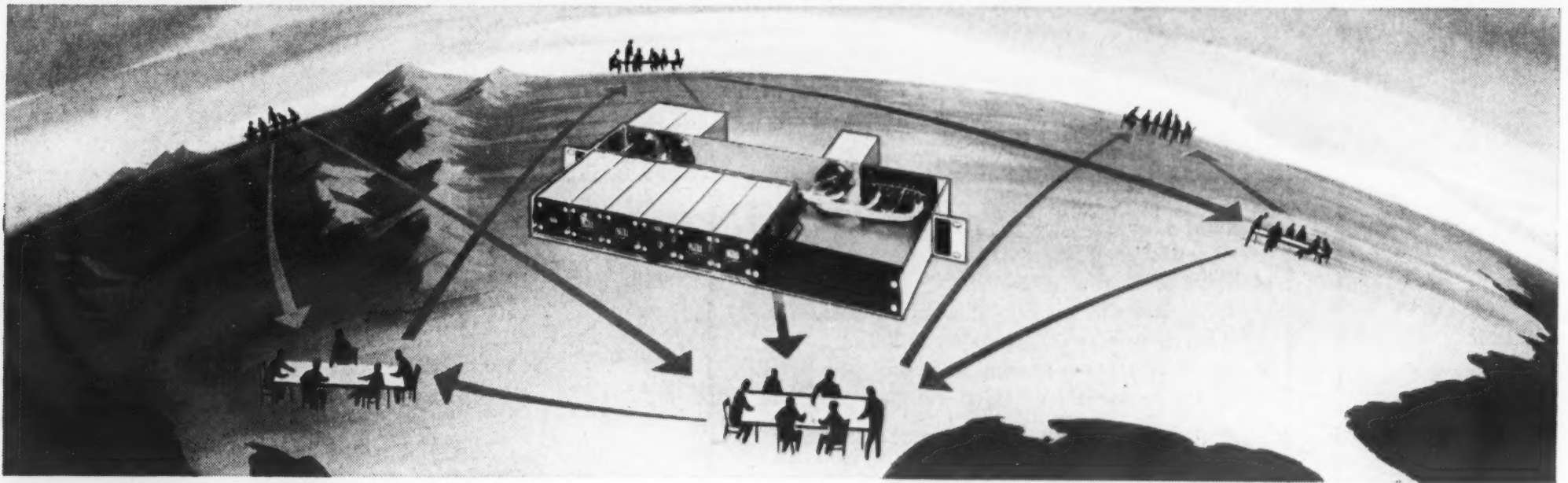
"Oh, tain't nuthin," the native replied. "I just shoot at something, and then draw target circles around whatever it is I hit."

This approach is hardly a suitable solution to our problem. We must aim our sights at the target of cost reduction—and hit it. Attempting to adjust the target to what has actually been accomplished will not do.

We have had many conferences with top industrial representatives about these problems. Extensive discussions relative to Cost Reduction matters were included in a series of procurement conferences held at Fort Monmouth last fall, at which altogether more than four hundred industrial representatives were in attendance. More such conferences are planned. I am confident that these will have significant results.

The Communications-Electronics Industry has ably met every challenge the Services have placed upon it in the past. I am sure they will meet this new one of reducing the increasing costs of equipping our combat forces with the tools they need to do their job. This challenge of price we must meet—as a team—if we are to provide that which must be provided for the defense of our country without seriously weakening our national economy. . . . price is an object.

## NEW...ALTEC LOUDSPEAKING TELEPHONE SYSTEM FOR INTER-OFFICE TELEPHONE CONFERENCES COAST-TO-COAST



### Important Advance in Military and Civilian Group Communication Systems

Coast-to-Coast inter-office telephone conferences with many talkers at each location are now possible with the new ALTEC 7302 Loudspeaking Telephone System. The 7302 is a fully transistorized system that maintains uniform talking and listening levels regardless of distance with speech transmission of such great fidelity that familiar voices are recognizable instantly. With an effective audio coverage of a large size executive office, the system offers freedom of movement and comfortable hands-free operation to large groups of talkers.

The 7302 operates on existing telephone lines in conjunction with type 510 set or equivalent. Associated ALTEC equipment includes the 755C Loudspeaker and one of the following ALTEC Cardioid Microphones:

Models M-30, 683A, or 685A. The 7302 mounts in standard 19" relay rack and occupies only 1 3/4" rack height. Power is supplied to the system from central office or PBX quiet battery supply of 24-26 v DC.

This system—now in use by a nation-wide retailer and a drug chain—provides the answer to their needs for instant consultation among their executives at branch offices throughout the country. With this system, you can now fill the many requests for this type of service from brokerage houses, military command facilities, and any organizations requiring group discussion of problems among specialists in separate locations. For complete information write Dept. S-6-T

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sion to 600 channels.

Lower initial, expansion and  
maintenance costs.

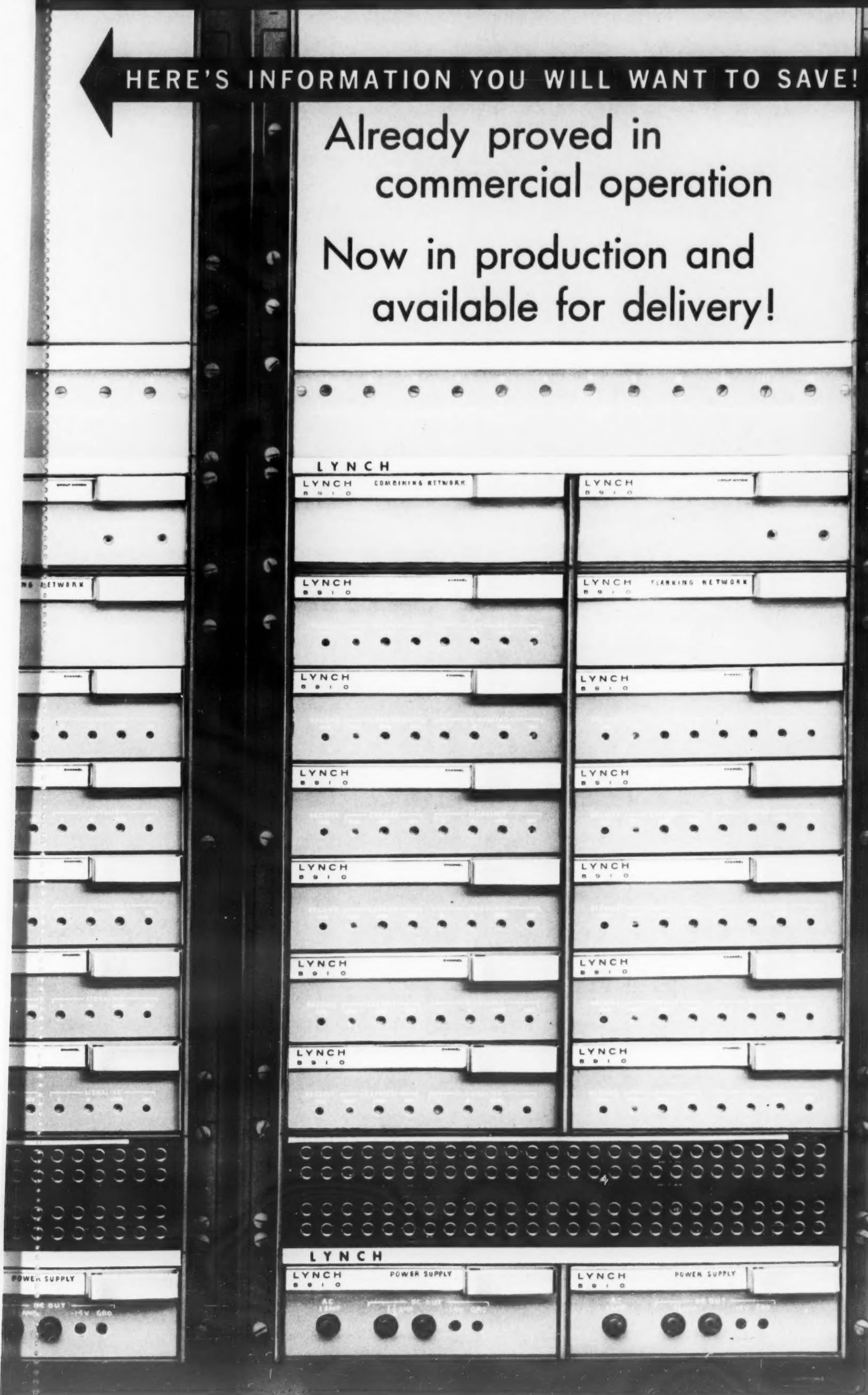
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nation of the need for common  
equipment.

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reinsert configurations.

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to 120 channels with no equip-  
ment common to more than 12  
channels, except for the power  
supply.

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TODAY.

*Turn the page  
for full details*





**B910****SOLID STATE  
MULTIPLEXING SYSTEM***Lynch***LOW-COST  
DEPENDABILITY**

The Lynch B910 is a fully transistorized system offering exceptional operating flexibility and economy for microwave multiplexing applications, and it is also expandable to cable and wire-line operations on a carrier frequency basis to complete a communications system. Spectrum utilization conforms to CCITT recommendations. Lynch also has available an alternate modulation plan to facilitate economical and simple

"breakout" of groups of 12 or less voice channels at any repeater or junction station along the line. System arrangements are available which will connect into Western Electric or other carriers of a similar type operating within a corresponding frequency range.

The Lynch B910 system does not penalize the small user... it is economically practical for small and large users alike.

The individual channels, occupying a four kilocycle segment, utilize single-sideband suppressed carrier transmission for maximum utilization of the microwave baseband and are individually stackable to the group maximum of 12 channels. Beyond the basic group of 12 channels, the system may be expanded progressively by group modulation methods, to 600 or more channels. It is not necessary to add groups in ascending frequency order, but they may be added at the frequencies required by the microwave system channeling plan according to the individual application.

Each channel of the B910 is completely self-contained in one horizontal drawer, with the exception of the power supply, terminating set and jack field, and includes an individual crystal controlled oscillator for modulation purposes and an individual oscillator for signaling. E & M signaling is standard for all units with all standard telephone signaling arrangements (ringdown, loop, subscriber, etc.) available as optional applique panels. Automatic standby power supply is also available.

An entirely new B910 filter design allows the basic 12 channel system to be translated directly to the 60 to 108 kc spectrum in one modulation step offering a substantial savings in the cost of intermediate group equipment, extra wiring, assembly and testing. In addition, a unique way of deriving the first supergroup (60 to 300 kc) makes it possible to place 120 channels on the microwave baseband without the use of supergroup equipment. No active equipment (except power supply) then affects more than 12 channels.

The Lynch B910 was designed and built specifically for microwave multiplexing application to provide a maximum number of channels on a minimum cost-per-channel basis. Particular emphasis has been given to equipment design with regards to maximum reliability, coordination, operating flexibility and ease of maintenance.

*the essential facts . . .***GENERAL**

**TRANSMISSION** . Single-sideband, suppressed carrier.

**CHANNELS** . . . 1 to 600

**CHANNEL**

**SPACING** . . . . 4 kcs

**SIGNALING** . . . E & M or no signaling, standard. All other standard signaling options available with converter panels. Standard 3825 cps on-off signaling. Channel failure indicated by permanent busy signal.

**POWER** . . . . . Battery or 117 VAC. Approx. 1.2 watts per channel terminal.

**OPERATING**

**TEMPERATURES** . -20° C to +60° C (-4° F to +140° F)

**NOISE**

(Maximum) . . . . Idle circuit 15 dba, loaded 30 dba.

**RADIO BASEBAND CONNECTION**

**LEVELS** . . . . . -30 dbm send and receive (approx.).

**IMPEDANCE** . . . 75 ohms balanced and unbalanced or other impedances optional.

**VOICE FREQUENCY****FREQUENCY**

**RESPONSE** . . . . 300 to 3400 cps +1, -3 db.

**IMPEDANCE** . . . Four-wire, 600 ohms balanced. Two-wire, 600 or 900 ohms balanced with provisions for precision balanced network.

**LEVELS** . . . . . Four-wire, -16 dbm. in, +7 dbm out. Two-wire, 0 dbm send, receive +1 dbm maximum.

**HARMONIC****DISTORTION AT**

**TEST TONE LEVEL** 2% total maximum at 300 to 3400 cps.

**LEVEL STABILITY** ±1.5 db with seasonal line-ups.

*Lynch***LYNCH COMMUNICATION SYSTEMS INC.**

695 BRYANT ST. SAN FRANCISCO 7, CALIFORNIA • EXBROOK 7-1471. AREA CODE 415





### When the Telegraph Came to Atlanta (Cont. from p. 8)

were captured. The *General* now rests in the railway station at Chattanooga, and the *Texas* is in the Cyclorama in Atlanta.

### The Military Telegraph System

Soon after the Civil War started, the U. S. Signal Corps was organized with Major (later Colonel) Albert J. Myer as the first Signal Officer. The military telegraph system played an important part in many of the battles.

One interesting example was the military telegraph circuit used at the Battle of Kennesaw Mountain, near Marietta. General Sherman and his forces were spread out on a ten mile front with General Schofield on the right flank and General McPherson on the left flank. General Sherman's headquarters were the intermediate "drop" on the circuit and furnished instant communication with his entire line of battle around the mountain.

Thus, the telegraph first proved its military value in this conflict, with many acts of heroism and ingenuity on both sides. In emergencies a telegrapher would sometimes strip off the insulation and place the bare wire on his tongue to receive the message.

By 1863, thirty Federal signal units had been organized and they suffered 78 casualties including 22 deaths.

After the war the telegraph became even more important to the nation. Along with the railroads the telegraph was an important factor in opening up the West. Daily newspapers now carried news only a few minutes old from points in the U. S. and the entire world. Telegraphic weather reports made an effective Weather Bureau possible when there was no other means of rapid and national communications. The telegraph played an important part in the daily life of nearly every citizen and business enterprise.

### The Golden Age of the Telegraph

From around 1900 to 1925 was called the "Golden Age of Morse Telegraphy." This was the most colorful era of the chattering telegraph key. Many are the stories and legends of these "Knights and Ladies of the Key."

One night Will Rogers was waiting for a train in a small Oklahoma cow town and heard the telegrapher playing a guitar. Rogers thought he was good, and suggested that he try Hol-

lywood. He did, and became the first singing cowboy of the movies. His name was Gene Autry.

In Atlanta, a young lawyer filed a telegram in a Western Union branch office and soon fell in love with the lady telegrapher. They were married, and she is the wife of Atlanta's long-time mayor, William B. Hartsfield.

One of telegraphy's most famous wandering "boomer" operators was named Thomas A. Edison, who was such a good receiver that no sending operator could "run him up."

Around 1903 there was a pretty, little 16-year old girl telegrapher in

the S. A. L. Railway Depot at Ailey, Ga. She later became the wife of a governor, the mother of a governor and of a U. S. Senator from Georgia. Her name is Mrs. Eugene Talmadge.

F. H. Sholar, the Postal Telegraph Manager, and Howard Reed, the lineman at Gainesville, Ga., survived the tornado that wrecked the office and the town killing hundreds of people. Slightly injured, they salvaged telegraph instruments, made their way to Reed's home out of the damaged area and had a telegraph circuit working to Atlanta while houses were still being tossed around.

In a little Georgia town when you

The advertisement features a central graphic with four rounded rectangular panels. The top-left panel shows two figures in a control room with the label "SECURITY". The top-right panel shows a rocket launch with the label "OBSERVATION". The bottom-left panel shows a large satellite dish with the label "ANTENNA ALIGNMENT". The bottom-right panel shows a control room with multiple video screens and the label "DATA TRANSFER". Below these panels, the text "PHILCO CLOSED CIRCUIT TV SYSTEMS" is prominently displayed.

### WIDELY USED BY THE MILITARY

Philco closed circuit TV systems are being used by the Military for many diverse applications...remote observation of missile launchings...gate watching...area perimeter surveillance...data transfer...visual communication...training programs...aligning satellite tracking antennas. Highly developed, fully transistorized equipment guarantees maximum reliability, freedom from maintenance problems and ease of operation. Philco engineers will be glad to assist you in adapting closed circuit TV to your specific requirements.

### Government & Industrial Group

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In Canada: Philco Corp. of Canada, Ltd., Don Mills, Ontario

In Europe: Philco Corporation S.A., 3 Avenue Beauregard, Fribourg

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meet the grey haired old telegrapher you would never know that as a young man he was engaged to a beautiful but fickle girl, who ran off and married another fellow. She was considerate enough to telegraph back that the engagement was off and announce her marriage. The telegrapher "copied" his own message with the news.

One cold morning during World War II, Eddie L. Morgan opened the Western Union office at Athens, Ga. The second message that came through was addressed to him and read: "The Secretary of War regrets to inform you that your son. . . ."

But the story had a happy ending. The son was a prisoner and finally came home. It was almost like a page out of William Saroyan's *The Human Comedy* come to life. It will be remembered that Saroyan was once a postal telegraph messenger boy.

Into this wonderful world of telegraphy came a thing called an automatic printer which cast its deadly shadow across the scene. Within a few years the chattering little sounders were almost silent and the Morse code was becoming a vanishing language. Then the railroads began dispatching trains by telephone and ra-

dio. The clicking sounds in the depot which were so much a part of America, disappeared along with the steam locomotive. Thus passed a great era. A great army of old time telegraphers wanted to keep alive the legends, memories and friendships of the past.

In 1945 the Morse Telegraph Club of America, Inc. (MTCA) was organized in Los Angeles. The club now has some 50 chapters.

Each year on the fourth Saturday of April all the chapters hold a meeting or banquet honoring Morse, whose birth date is April 27th. Programs include a tribute to Morse, entertainment, and a "bull session" where the old timers spin yarns of adventure of the long ago. Another feature is the old time Morse telegraph circuit which Western Union sets up completely around the country connecting each meeting. The old "brass pounders" chat with friends all over the nation. It is a moving and heartwarming thing to see an old, old man with misty eyes hearing his beloved dots and dashes once again. There is genuine happiness in his face when he sends, and hears his halting and shaky dots and dashes speed out across the land.

Some chapters sponsor public meetings and TV or radio programs spotlighting local or national telegraph history.


#### Public Unveiling

Because of Atlanta's unique telegraph history, that Chapter of MTCA placed a bronze plaque at the location of that city's first telegraph office, and held a public unveiling and ceremony on May 24, 1959. Appearing on the program were J. Clyde Mixon, president, Atlanta and West Point Railroad; Harwell C. Ozburn, Central of Georgia Railway, Savannah; A. E. Arnold, Western Union; Franklin M. Garrett, famed Atlanta historian; and Wilbur G. Kurtz, Sr., artist-historian and a technical director for *Gone With the Wind*.

Mr. Garrett and Mr. Kurtz pointed out to the large audience many interesting landmarks in the vicinity and gave some interesting sketches of Atlanta's early history.

So far as can be determined, Atlanta is the only city having such a marker identifying its first telegrapher and the location of its first telegraph office. It is a heartfelt tribute and a salute from the fast thinning ranks of a once great army of Morse Telegraphers to their comrades who are now tapping the golden keys in Valhalla.

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is absolute ...



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# Engineering Communications: Heave Ho

IN AN ENGINEERING department, one of the most difficult tasks is to disentangle the intertwined rigging of vertical lines of administrative authority from the horizontal lines of group functional inter-relationships. And tied up in all this is the complicated ropework of lines of communication. Now, it stands to reason that you don't want your communication cordage so taut that your sails won't function when engineers simply want to get a point across to someone in another group. Nor do you want the hawsers so loose that you have no communication system at all.

The areas of product design office and project office should be examined periodically, for, under many engineering department systems, neither one reports administratively to the other; both work directly for the chief engineer. And this skipper is theoretically up on the bridge performing high-level coordinating supervision. Here's the way it's supposed to work: the skipper tells the project office master mariner to make sure you are all going in the right direction without spending too much customer money. Then the skipper orders the first mate in charge of product design to back up the project office master mariner by seeing to it that the proper designs are drawn. Of course, the first mate in charge of product design has a great many administrative duties, so he leaves the technical details up to the second mate in charge of electronic design, who in turn passes orders to the boatswains in charge of design groups, and the crew then gets to work.

As the project begins to get up a good head of steam, it becomes obvious that the project engineer must give directions to the design group engineers and perhaps to the design engineers themselves. Now, what should he do? Since the project engineer has no direct administrative control over either the product design officers or deck hands, should he go strictly through channels: through the first mate, to the second mate, to the bos'n, to the design engineers? Or does he have permission to talk

directly to the hands, or at least to the boatswains? Obviously, your skipper should provide some leadership here, but, at the same time, the solution should be part of an over-all department communication pattern.

In order to determine what is permissible in communications and what is prohibitive, you should define the different kinds of communication used. First of all, there is formal communication involving major design decisions which are part of official reports. These reports should follow the lines of administrative authority. Major design decisions, even though communicated informally, should also go through administrative channels and subsequently be documented in official reports.

As the project gets under way, however, there is a great deal of communication which must somehow pass between the project office and the design groups. To say that a design engineer must check with his boss before giving out information to the project office is reasonable and necessary, but to say that information from the design engineer must go through his boss and his boss's boss before it even gets to the project office is, of course, intolerable. Good communication is simply communication that works. Design engineers should be permitted to deal directly with the project office without going through a hierarchy of management levels, just so long as this system gets the job done. But this system won't work if the bosses in between are not properly informed, nor if they object to the system. But, assuming that they do not object to their people fraternizing with the project engineer, this system is workable.

Kinks in the communication pipeline are much more likely to occur during the direct flow from the project engineer to design engineers. But if the project engineer issues only project instructions to design engineers and if the bosses issue the orders, the kinks won't be so serious as to require a new conduit.

by S. W. BROSSMAN

Chairman

Division of Language Arts

Chaffey College



# HAZELTINE COLOR FILM ANALYZER

by DR. R. K. HELLMANN

Vice President, Hazeltine Research Corporation

THE AIR FORCE Missile Test Center, with its launching site at Cape Canaveral, undoubtedly is one of the world's largest electronic laboratories. Its wide range of complex electrical equipment and systems includes the new electronic color film analyzer, which has made possible prompt printing of the color pictures taken of all pre-launching and launching activities. According to officials at the Center, the motion pictures are useful for evaluation and review of these operations, and it is essential that they are available for viewing as soon as possible.

## Color TV Pioneer

During the past twenty years, most of the progress in electronics has been brought about by the pressing military need for breakthroughs in the state of the art. However, the color film analyzer being employed at the Missile Test Center was developed in conjunction with Hazeltine Corporation's contributions to the color television field. The 36-year old firm has been one of the pioneers in this area and holds many basic patents in color television.

The analyzer provides immediate information for setting up film print-

ers to obtain high quality positive prints from negative or positive film. It displays a positive color picture on a color television tube instantaneously when a color original (negative) is inserted. Color balance and density are adjusted by calibrated controls, whose settings are used by a printer to produce a positive virtually identical to the displayed picture.

The analyzer uses television techniques to simulate the properties of positive film in spectral taking sensitivities, gamma, contrast and unwanted dye absorptions.

If the analyzer were not used, film would have to be processed through a trial and error method to make the necessary corrections in color balance and printing density. This requires making a first trial print and then additional prints for evaluation and correction by successive approximation until all scenes are satisfactory. Often a film may be printed as many as six times before the desired characteristics are achieved. The trial and error method causes expensive delays before acceptable prints can be obtained and involves waste of valuable film stock.

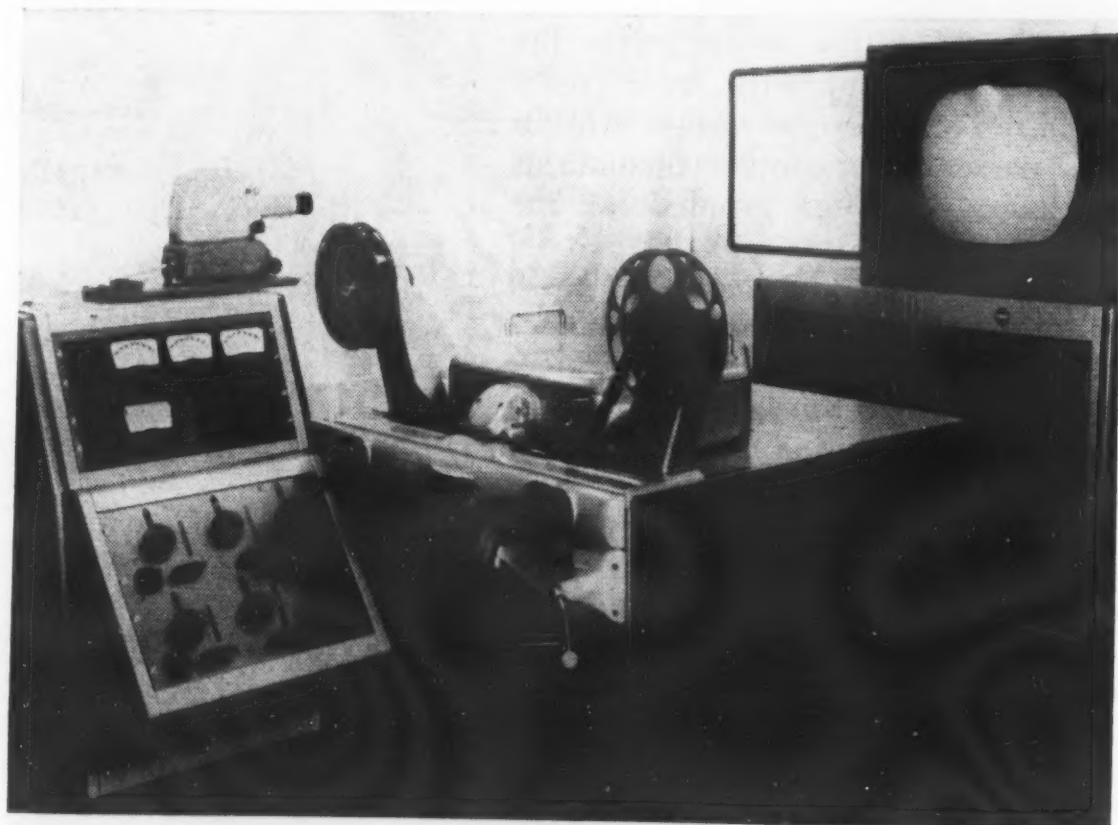
Not only is the Hazeltine color film analyzer being used in the nation's missile program, but many of today's

Hollywood color extravaganzas are being processed electronically to afford rapid printing and distribution to theatres throughout the world. Employed by large motion picture film processing laboratories, the analyzer has met with such success that early this year it was nominated for a technical award from the Academy of Motion Picture Arts and Sciences.

## Analyzer Operation

In the Hazeltine analyzer, the original film representing a scene to be "timed" is placed in the pick-up gate and a television type scanner produces signals corresponding to the scene. These signals are then electrically modified to represent the characteristics of the positive print stock and the effects of the printing and processing operations. The signals are then applied to a color television picture tube with the proper electrical polarity to afford a positive color view for the observer. Three calibrated adjustment knobs enable the observer to vary the television picture in color balance and brightness (equivalent to density in the positive film print). These are adjusted for the desired reproduction. Scales associated with the knobs then show the adjustments required

*The Hazeltine Color Film Analyzer, now being leased to motion picture processing studios and the United States Government, eliminates the costly, time-consuming trial and error steps in the printing of color film. It utilizes color television techniques to aid in attaining the optimum in quality color motion picture prints. The Analyzer instantaneously displays on its color television picture tube a positive color picture obtained from a negative (or positive) color film original. This electronic instrument provides a means to adjust the color balance and density of the displayed picture. At the same time, it supplies information for setting up a photographic printer so that the desired color print, identical to the picture displayed on the television tube, can be obtained.*





on the printer to obtain the printing-light conditions which will produce these characteristics in the finished positive film.

Included in the equipment is an optical projector which serves as a certifying means for periodically calibrating the electronic equipment. For this purpose, a standard reference, original or intermediate film negative or positive is placed in the television film gate and a positive print, made from this original by the printing and chemical processing to be employed, is inserted in the optical projector. The calibration controls of the analyzer are then adjusted to provide a match of the television image with the optically projected positive print. These calibration controls are located under a cover, where they are available to the operator whenever needed. The periodic calibration serves for an initial adjustment of the equipment and to check that adjustments have not changed.

#### Positive Pictures

The optical projector may also be used to produce a positive picture for comparison purposes. This is desirable to compensate for the adaptation of the observer's eyes to the ambient light condition which could alter his judgment of density and color balance. Positive transparencies of reference scenes of particular types, known to have good color balance, although not necessarily the same shot as in the negative being timed, can thus be used as guides to determine the proper reproduction for the scenes in the negative.

The analyzer operates by creating electrical signals which are analogs of the positive film as it is processed. These signals are modified in successive steps in accordance with the photographic processes.

Since the analyzer closely parallels the positive film stock and the printing process, it will result in satisfactory prints when used with any original or intermediate film stock.

The color film analyzer is another example of how electronic techniques can be applied to the photography field. Hazeltine has already adapted the analyzer for still photography. Certainly, electronics has much to contribute in making a photography process faster and more precise. Many advances in this field will undoubtedly be made through techniques acquired in the development of industrial and consumer products as well as military equipment and systems.

## LONG RANGE INPUT / 1794

News of the recapture of Condé from the Austrians was sped to the French Revolutionary Convention at Paris in a matter of minutes via Claude Chappe's amazing télégraphe aérienne, or relay aerial telegraph, Sept. 1, 1794. A new era in rapid communications had begun.

Today, instantaneous and completely reliable Electronic Communications insure the immediate and continuous interchange of intelligence throughout the Free World. ECI is proud of its initiative and responsibilities in the design, development and manufacture of high precision electronic equipment to the critical specifications required in various aerospace and surface roles vital to our National Defense and to scientific achievement. An example is ALRI—Airborne Long Range Input—a program where ECI communications and data link equipment fill an integral and essential requirement in linking USAF's advanced early warning system to SAGE—our continental defense network.



REGIONAL OFFICES: Washington, D. C., Boston, Mass., Dayton, O., No. Hollywood, Calif.



# "WEATHER EYE" IN SPACE



## RCA-NASA Development of TIROS Advances Progress in Worldwide Weather Forecasting

From its vantage point in space, TIROS is sending down to earth new, more definite pictures and data of the world's everchanging weather patterns to aid man in his ageless efforts to control the elements.

Incorporating revolutionary and advanced electronic equipment, TIROS was designed, developed and built by RCA's Astro-Electronics Division for National Aeronautics and Space Administration. Within its small circumference are miniature TV cameras, tape recorders, TV transmitters, command receivers, timing mechanisms, beacons and telemetry equipment. In addition, it carries new scanning and

non-scanning Infra-red Sensing Devices, developed by NASA, to measure and record the heat radiation of the earth and its cloud cover, and a revolutionary new Magnetic Orientation Device to capitalize on the effects of the earth's magnetic field and maintain favorable orientation of the satellite for long periods.

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# A WINDOM FOR IZMIR

by Specialist Fifth Class JOSEPH E. WATSON

WHEN INSTALLATION of a 15-kilowatt Press Wireless transmitter was completed recently at NATO Transmitter Site near Izmir, Turkey, it became apparent that all engineering problems except one had been well taken care of in advance. The equipment had been assigned to work to Mediterranean fleet units, wherever they may roam. C-W keying and external frequency shifter provisions had been made to satisfy circuit requirements. Power input lines were more than adequate to feed the big TEB, as the Navy knows it, even allowing for the finagle factor which enters when an old Fort Monmouth hand tightens up the plate overload relays a bit.

One problem only was left to be solved later—what antenna?

The civilian technical representative who installed the transmitter checked it out into a 3-wire folded dipole cut for the vicinity of 12 megacycles. It worked fine, he was satisfied, and his job was done. But the circuit requirements were such that a single antenna resonant at a specific frequency would be almost useless in communication with fleet units which might be anywhere in the Mediterranean, at any distance, any azimuth, any time of day or night. More than one antenna was out of the question, partly for reason of insufficient park space, but mainly because many of the operators were still in OJT status and considered presently unable to cope with a complex of switching or strapping arrangement.

So here was needed an omnidirectional, broadband—2 to 20-plus megacycles—antenna, easy to load into, requiring no adjusting apparatus external to the transmitter itself, and capable of handling a transmitter nominally rated at 15 kilowatts output. Goodbye to every antenna in the book!

Since no instructions had been passed down from higher headquar-

ters, the maintenance men of NATO Transmitters assumed they had tacitly been handed the baby to hold for a while. So the coffee pot was put on, the books were dusted off, and brains were shifted into a higher gear. These latter two conditions were abnormal, indeed. But all the conference accomplished was the one-by-one rejection of the terminated rhombic (too directional) the Vee (likewise), the dipole in all its forms (frequency-sensitive), the single long wire (not enough space), and others. One wag suggested a vertical whip, the Antenna Tuning Unit from a BC-610, and tuning for maximum smoke.

## *Designing a Windom*

Designing an antenna would appear to be apple pie to any group containing Signal Corps radiomen; of this species hardly one can be found who will not confess, under torture, brainwashing, or drugs, to being an antenna expert. Here, however, the experts were stumped—until one of them reached into the darker folds of his duffle bag and came up with something called a Windom.

This, to the uninitiated, is a horizontal antenna cut to about a half-wavelength at the lowest frequency to be used, fed by a transmission line of uncritical impedance and indefinite length at a point somewhere between 14 and 35 per cent of the total length from center.

The principal virtue of the Windom, its champion pointed out, is that it works. It was, he believed, developed by a British amateur years ago; some manufacturers list it as a good all-band antenna for their Ham gear. He had never seen it used in a communications-type station or carrying higher power than 500 watts. It was quietly agreed among the assembled Air Force technicians and Signal Corps men that it would

be put up and tried, with everybody keeping pretty well mum until the results were known.

For the particular circuit, a wire approximately 170 feet long was cut at 57 feet from one end and connected to a standard heavy-duty transmission line of 12-inch spacing and 600 ohms characteristic impedance. A random frequency about halfway up the complement was selected, and two Signal Corps men undertook the job of tuning. The Air Force men stood by, ready to give the inter-service razzberry in event of failure; the Greek and Turkish operators, not knowing precisely what to expect, watched silently but with the fire extinguishers and exits in view.

The TEB transmitter, similar to the PW-15-A, contains a versatile antenna tuning system of two tuned circuits, each connected at its "hot" end to a transmission line wire, and at its "cold" end, through capacitance, to ground. The Signalmen relied on the independent tuning feature of these circuits, plus the possibility of shifting R-F ground a little one way or the other, to obtain a reasonable balance in transmission line currents despite the obvious eccentricity of the antenna. At first the unbalance was intolerable, but after much jockeying and dipping, current began to rise in the low meter until the tube plates were drawing evenly and well and the line currents were not more than 20 per cent apart—an acceptable figure even for some terminated rhombics at critical frequencies.

## *It Worked*

One thing remained for the Signal Corps purists to prove: that the currents showing on the line meters were of the transmission line and not of the antenna variety. If the latter, the efficiency of the system would be fractional because of the great length of

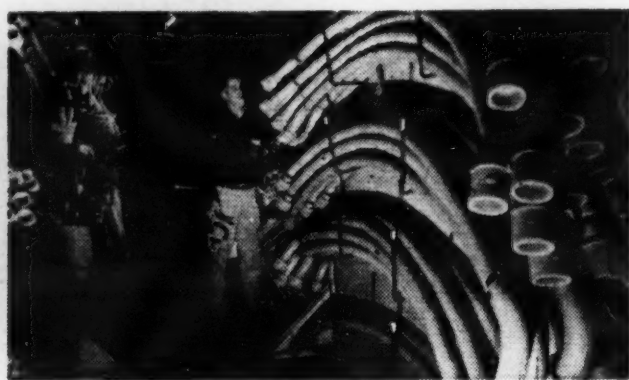




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line. A fluorescent tube was mounted several inches above and at right angles to the line, the transmitter having been turned off to avoid causing the tube to strike through capacitors to ground. It was reasoned that transmission-line currents would strike the fluorescent tube where antenna currents, being in phase and voltages being approximately equal, would not. When plate voltage and drive were restored, the tube lit up nicely. Q. E. D.

A report from the net control station, obtained a little while later, gave the radioteletype a "five-by," and the venerable Windom, which had done it before, was doing it again.

### Reliably Functioning

An explanation and analysis of this antenna and its functioning revert to the vague physical description a few paragraphs back. At high frequencies it behaves as a single long wire with major and minor lobes of radiation. At low frequencies it can be expected to show dipole properties except that the feed-point impedance can never be as low as 72 ohms. Nor can it have the high impedance of the end-fed Zepp, because it isn't end-fed. Thus the feed-point impedance is a compromise between high and low and there must always be standing waves on the line. Indeed, the entire design is a compromise between the dipole and the single long wire. At this installation the antenna was oriented to include the distant net control station in a major lobe regardless of frequency, trusting in minor lobes and ground reflection to give a usable signal strength in other directions. So far, barring the infrequent radio blackouts when nothing gets through, the TEB and the Windom have been reliable not only on their primary assigned circuit but for emergency use on others as well.

Theory gives no justification for claiming good over-all efficiency with the Windom. Losses may be severe at certain frequencies, but the "reserve horsepower" of the TEB transmitter makes it likely that at least 5 kilowatts can be put on the radiator at any frequency called for. There is no frequency at which the system will be highly efficient—conversely, there is no frequency at which it will be a total loss. There is no frequency above 3 megacycles at which this Windom will refuse to load the TEB to its full rated input.

And that, to Hams and old Signal Corps troopers, leaves little to be desired.



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**GREATER LOS ANGELES:** Pres.—John W. Atwood, Hughes Aircraft Co., Culver City, Calif. Sec.—Joseph H. Goodrich, Pacific Tel. & Tel. Co., 737 S. Flower St., Los Angeles 17, Calif.

**SACRAMENTO:** Sec.—Capt. Robert McMorrow, 951 La Sierra Drive.

**SAN DIEGO:** Pres.—Capt. B. L. Bailey, USN, Cmd. Off. Miramar Naval Air Station, Miramar 45, Calif. Sec.—J. C. Ortel, 5483 Redding Rd., San Diego 15, Calif.

**SAN FRANCISCO:** Pres.—Col. H. L. Davis, Jr., 331 Infantry Terrace, Presidio of San Francisco, Calif. Sec.—H. W. Weddell, Rm. 117, Bldg. 35, Presidio of San Francisco, Calif.

**SANTA BARBARA:** Pres.—RAdm. Clarence C. Ray, 63 Manzanita Lane, Star Route, Santa Barbara, Cal. Acting Sec.—E. E. Foley, P.O. Box 636, Santa Barbara, Calif.

**SEATTLE:** Pres.—RAdm. H. H. McCarley, USN, 436 168th St., S.E., Bellevue, Wash. Sec.—W. E. Cruse, 4001 W. Concord St.

## EUROPEAN REGION

Regional Vice President—Brig. Gen. Kenneth F. Zitzman, USA (Ret.), International Standard Engineering, Inc., 40 Rue de Sevres, Boulogne-sur-Seine, France.

**FRANKFURT:** Acting Pres.—Ralph L. Prokop, USA Procurement Center, APO 757, N. Y.

**LONDON:** Pres.—Lt. Col. W. H. Fritz, MAAG-UK, Box 28, FPO, NY, NY. Sec.—Lt. Col. S. B. Hunt, CINCNELM Staff, Box 6, FPO, NY, NY.

**PARIS:** Pres.—Maj. Gen. Frank W. Moorman, Signal Div., SHAPE, APO 55, N. Y., N. Y. Sec.—Maj. John E. Mills, 7th Signal Battalion, SHAPE, APO 55, NY, N.Y.

**SWITZERLAND:** Pres.—B. R. Dean, 13 Quai de L'ile, c/o RCA, Geneva, Sec.—Lt. Col. A. David, Royal Signal, British Army, U. N., Geneva.

## PACIFIC REGION

Regional Vice President—Maj. Gen. Gordon A. Blake, USAF, Hq PACAF, Box 2, APO 953, San Francisco, Calif.

**HAWAII:** Pres.—Col. W. A. Simpson, USA, Signal Office, Hq. USARPAC, APO 958, San Francisco, Calif. Sec.—Lt. Col. G. A. Kurkjian, USA (same address).

**KOREAN:** Acting Sec.—Col. J. E. Gonseth, Jr., J6 Div., UN Command, APO 301, San Francisco, Calif.

**MARIANAS:** Pres.—Cmdr. C. J. Alley, USN, U. S. Naval Comm. Sta., Navy 926, FPO, San Francisco, Calif. Sec.—Lt. Cmdr. W. Scott, USN, P. O. Box, FPO, San Francisco, Calif.

**OKINAWA:** Pres.—Lt. Col. Russell Marks, 313th Air Division, APO 239, San Francisco, Calif. Sec.—Thomas G. Byrd, Jr., Hqs. U.S. Army Signal Group, RYIS APO 331, San Francisco.

**PHILIPPINE:** Pres.—Lt. Col. A. W. Hall, STARCOM, QTRS. 31 Clark, U. S. Acan Station, Philippines, APO 74, San Francisco, Calif. Sec.—J. C. Behrick (same address).

**TOKYO:** Pres.—H. F. Van Zandt, Standard Electric Corp., Box 49, Shiba P.O., Tokyo, Japan. Sec.—P. W. Becker, Hq. U. S. Army Sig. Comm. Agency, APO 343, San Francisco, Calif.

## CHAPTERS AT LARGE

**ALASKA:** Pres.—Col. H. L. Hughes, USAF, Hq. Alaskan Air Command. Sec.—R. E. Witsiepe, Philco TechRep Div., Hqs., AAC, Box 6335, APO 942, Seattle, Wash.

**SAN JUAN:** Pres.—W. Siddall, Radio Corporation of Puerto Rico, P. O. Box 3746, San Juan 18, P. R. Sec.—A. R. Crumley, Jr., Crumley Radio Corp., Box 10073, Caparra Heights, San Juan.



# Chapter News

## REGION A

### Fort Monmouth

Lieutenant General Arthur G. Trudeau, chief of Research and Development, Department of the Army, Washington, was guest speaker at the March dinner meeting held at Gibbs Hall Officers Club. A capacity crowd, including delegates from local and metropolitan area electronic firms, heard his talk "New Age Demands New Measures."

Head table guests included: Major General William D. Hamlin, Fort Monmouth commander; Brigadier General William M. Thames, commanding officer, ADVENT Management Agency; Brigadier General Charles M. Baer, commandant, Army Signal School; chapter president Dr. Hans K. Ziegler, chief scientist, U. S. Army Signal Research and Development Laboratory.

Thomas Meloy, chairman of the board of Melpar, Inc., Falls Church, Va., addressed the chapter at the April meeting held at Gibbs Hall Officers Club. His subject was "Needs and Impacts of Basic Research." Dr. Hans K. Ziegler, chapter president, presided at the meeting.

The meeting was the last of the season at which there was a guest speaker. There will be no meetings in June, July and August.

### New York

AFCEA vice president Rear Admiral Frank Virden, Director of Naval Communications, addressed the chapter at the April 26 meeting on the subject of LOFTI—Low Frequency Trans-Ionospheric Communication System.

The pioneering accomplishments of satellite LOFTI in receiving very low frequency signals were described. This mode is under investigation as a means to improve communications with submerged submarines. Admiral Virden said the satellite LOFTI did not separate from Transit 3B and the orbit did not follow the planned pattern but made a complete excursion through the ionosphere. This developed a wider range of information than originally expected. A question and answer session followed the talk.

Final plans were made for the Annual Gala Garden Party on June 28 at Governors Island, during a board of directors meeting on June 4. All members and friends of the chapter are welcome to participate in this annual event sponsored by the Second Corps Area Signal Division. Colonel Charles Stanely, Chief Signal Officer, will host for this party at Governors Island.

### Rome-Utica

Dr. H. J. Woll, manager, Applied Research, Defense Electronic Products, Radio Corporation of America, was

guest speaker at the April 11 dinner meeting held at the Beeches. Seventy-one members and guests attended. Colonel Charles W. Gordon (Ret.) RCA, was chairman-of-the-day and introduced Dr. Woll.

"All-Electronic Reading Machine" was the subject of Dr. Woll's talk. He told the group that reading machines have demonstrated their capability for providing high speed input to computers for circumstances where the text material can be printed or type-written in a given type font and the format can be controlled. A more difficult problem is that of automatic reading of books. This problem is important because of an urgent need for automatic language translation, abstracting, indexing and editing.

RCA, Defense Electronic Products has completed the first phase of a research program on character recognition techniques suitable for free format, multiple font reading as required for automatic book reading.

Dr. Woll said the RCA reader incorporates electronic page scanning and recognizes the characters by optical cross correlation against a photographic mask. It reads while the document is stationary, the peak reading rate being approximately 500 characters per second. The error rates achieved against a standard printed type font have been excellent, i.e., better than one error per million characters. The alphabet in these tests was ten numbers, two alpha symbols, and four punctuation marks. Average "worst case" discrimination between similar characters is two-to-one.

### Syracuse

A dinner meeting was held April 12 at the Carrier Corporation Administration Building auditorium. One hundred seventy-five members and guests and their wives attended. Guest speaker was AFCEA national president Benjamin H. Oliver, Jr., vice president, upstate New York Telephone Co.

C. A. Nolph, sales manager, Military Equipment Department, Carrier Corp., gave a welcoming address to the group and showed a color film titled "Film Tour of the Carrier Plant."

Chapter president C. W. Getz introduced Mr. Oliver who spoke on "The Role of AFCEA." He outlined the developments in the communications field within our lifetime and pointed out that the tempo of improvements has been unbelievable. In less than forty years we have gone from unscheduled radio broadcasts to a planned program of teaching via television. Less than five years ago satellites were unheard of, yet currently we are discussing the possibilities of establishing a communications network by using satellites. He said that these

discussions have reached the point of exact plans and the only points left open are how they are to be administered.

Mr. Oliver brought out the increasing necessity for AFCEA members to keep abreast of developments in order to fulfill the mission of maintaining good civilian-military liaisons. He said that our military forces must have the newest communications ideas available to them as rapidly as possible in order to stay ahead in the arms race, and it is only by keeping our contacts open that this can be done.

## REGION B1

### Washington

The final luncheon meeting of the 1960-61 season was held May 4 at the Willard Hotel. Guest speaker Henry Loomis, director, Broadcasting Service, United States Information Agency, spoke on "International Broadcasting—The Heightening Challenge."

He told the group where we stand and where the world is heading in the radio scramble for mankind's understanding and support all around the globe.

## REGION C

### Augusta-Ft. Gordon

A \$25 savings bond was presented by the chapter to Aiken, S. C. senior Patrick Braddy, 17, who constructed a communications exhibit involving infrared light. The presentation was made by Brig. Gen. B. H. Pochyla, commanding general, Army Signal Training Center, during the annual Central Savannah River Area Science Fair.

The ceremony was televised by the Southeastern Signal School Television Branch and transmitted into thousands of area homes.

### Cape Canaveral

A general business meeting and election of officers highlighted the April 20 luncheon meeting held at the Officers Club, Patrick Air Force Base. The 25 members and guests attending gave retiring president Lieutenant Colonel James W. Kelly a standing vote of thanks for his service during the past year.

New officers are: president, George Meredith, Collins Radio Co.; first vice president, Walton Wells, Lieutenant (jg) USN; second vice president, William Burgess, Radio Corporation of America; secretary, Lynn A. Breece, Pan American World Airways; treasurer, Ed McCarthy, Pan American World Airways.

The chapter participated in a meet-

(Continued on page 50)





**New York**—RAdm. Frank Virden, AFCEA vice president, guest speaker at the April 26 meeting with chapter president Glenn Montgomery (center) and Col. D. A. Brock (right), Deputy Signal Officer, First Army.



**Ft. Monmouth**—Pictured at the April meeting are: (L to R) Maj. Gen. W. D. Hamlin; guest speaker Thomas Meloy, chairman of the board, Melpar, Inc.; chapter president Dr. H. K. Ziegler.



**Chicago**—Welcoming committee greets guest speaker Maj. Gen. Harold K. Johnson, Commandant, U. S. Army Command and General Staff College, on arrival for March 30 meeting: (R to L) Capt. K. R. Beyer; Capt. R. H. Northwood; Col. L. M. Young; Gen. Johnson; chapter president W. L. McGuire, vice president, Automatic Electric Co.; Col. T. W. Gilman; Col. J. R. Ourand; Maj. R. D. Newby.



**Switzerland**—Recently elected chapter officers: (L to R) secretary-treasurer Adrian David, Lt. Col., Royal Signals British Army; president B. D. Dean, former Lt. U. S. Marine Corps; vice president Frank C. Chevalier, Col., USAR.



**Tokyo**—At the April 14 dinner meeting: (L to R) Capt. Edward Knepper, USN; Mrs. Howard Van Zandt; guest speaker Donald Parris; chapter president Howard Van Zandt.



ing of the Canaveral Council of Joint Technical Societies on April 27. Guest speaker was Dr. H. Nelson Upthegrove, satellite systems engineer, Bell Laboratories. His topic was "Commercial Satellite Systems."

Dr. Ibison, Electronics Communications, Inc., was guest speaker at the May 18 chapter meeting. He presented a program titled "Youth Astronautics Program."

The meeting was a social affair attended by ladies and special guest students from local high schools. New officers were installed at the gathering.

### **Gulf Coast**

A dinner meeting was held April 3 at the Trade Winds Hotel, Biloxi, Miss. Ninety-nine members and guests attended.

Dr. Frederick G. Collins, USAF Hospital, Keesler Air Force Base, introduced a film titled "Man in Space," which deals with the physiological and psychological conditions which effect man in space travel.

The May 1 meeting featured a talk by Lieutenant Colonel Russell E. Gray, Missile Test Center, Cape Canaveral, Fla., on "Missile Testing."

### **Northwest Florida**

A dinner meeting and annual election of officers was held March 24 at the Waltonian Room, Staff Cafe, Ft. Walton Beach, Fla. Twenty-nine members and guests were present. Special guests were Colonel and Mrs. Ben F. Hardaway.

By unanimous vote the following were elected to fill the offices of the chapter: president, Colonel Sterling K. Briggs, Eglin Air Force Base; 1st vice president, Timothy R. Long, Tyndal Air Force Base; 2nd vice president, John M. Fair, Eglin Air Force Base; 3rd vice president, Captain William O. White; secretary-treasurer, Major Norman E. Zielinski, Eglin Air Force Base.

Following election of officers and the business meeting Colonel Hardaway, chief, High Altitude Branch, Hq. APGC, showed a film titled "APGC Capabilities." The color film, which was narrated by Colonel Hardaway, showed the work being carried on by the Air Proving Ground Center.

### **Pensacola**

W. Kelly Mosley of Atlanta, AFCEA regional vice president, presented the chapter charter at a dinner meeting held March 24 at Bartels Restaurant.

The twenty-eight members and guests attending were given a demonstration of direct distance dialing. Representatives of Southern Bell Telephone Co. called Benjamin H. Oliver, Jr., AFCEA president, and Rear Admiral Frank Virden, AFCEA vice president, at their homes. Both extended greetings and best wishes to members and guests through speakers over the direct telephone system.

## **REGION D**

### **South Texas**

A dinner meeting was held April 11 at the Officers Club, Randolph Air Force Base. The double feature program included a talk by Dick Calvert, Alamo National Bank, who spoke on the use of closed-circuit TV in daily banking operations. He was introduced by Leroy Zimmerman of Southwest Radio and Sound Equipment Company.

Also on the program was Gene Smith, sales manager, Dage division of Thompson Ramo Wooldridge, who spoke on the applications of closed-circuit TV on the battlefield, on Naval vessels and in industry.

### **Tinker-Oklahoma City**

The April 20 dinner meeting was held at the Tinker Air Force Base Officers Club and attended by 55 members and guests.

Guest speaker was Clayton F. Van Thullenar, director of the National Severe Storms Project, which has just been based at Will Rogers Field in Oklahoma City.

Mr. Van Thullenar's presentation concerned the work of the project in which the Air Force, Army, National Aeronautics and Space Administration, Federal Aviation Agency and Wright Air Development Center are cooperating. It included information concerning types of aircraft used, such as the U2, F106, B47 and B66, and the "Roughriders," the men who fly them into squall lines and storm centers. He also discussed measuring equipment and radar used on the ground and in the aircraft. The dangers of clear air turbulence as well as storm turbulence were emphasized.

The compiled data is expected to produce methods for aircraft to safely ride out unexpected thunder-storms and to produce engineering figures to enable designers to produce supersonic aircraft for long range missions.

Five outstanding students of Midwest City High School were present as guests of the chapter and are being enrolled as student members of AFCEA. The students are Peggy Lemme, Joe A. Provine, Ronald L. Saunders, John C. Williams and John J. Thomasson. This is a result of the chapter's efforts to interest high school students in continuing their education in scientific fields and it is hoped that the activity can be extended shortly to Oklahoma City high schools.

## **REGION E**

### **Chicago**

Major General Harold K. Johnson, commandant, U. S. Army Command and General Staff College, Ft. Leavenworth, Kansas, was principal speaker at the March 30 meeting held at Automatic Electric Co., Northlake.

Host of the meeting, attended by more than 300 members, was Herbert

F. Lello, president of Automatic Electric Co.

General Johnson, a graduate of West Point and a survivor of the Bataan "Death March," said the U. S. Army will be the final instrument, and to do its job help is needed through more rugged, more reliable communications systems.

Emphasizing the role of communications in providing timely information about the enemy, he said maneuvers in the heat of battle are predicated upon what we know and what we have been told, so that units can move up or change directions. What is needed most now, he added, is an actual picture of the enemy which is available at all times.

One of the most vital developments the communications industry can supply, General Johnson concluded, is "knowledge derived from the ability to see under all conditions of visibility, weather, terrain and climate."

### **Kansas City**

Seventy-two members and guests attended the January 16 dinner meeting held at the Officers Club, Richards Gebaur Air Force Base. Speaker of the evening was chapter vice president P. H. Hansen, executive vice president, United Utilities. He gave a talk on the "Independent Telephone Industry in Defense Communications."

Glenn E. Nash, communications procedures specialist, Federal Aviation Agency, Region Three, was guest speaker at the February 23 meeting. Seventy-eight members and guests attended. Mr. Nash gave a talk on weather communication, from 35 words per minute to the sophisticated automation of the jet age. Illustrative slides supplemented his explanation of FAA's new high-speed automatic data interchange system.

The March 23 meeting was held at Officers Club, Richards Gebaur Air Force Base. Guest speaker was Joseph L. Eachbacher, science demonstrator, Southwestern Bell Telephone Company, who spoke to the 51 members and guests attending.

He gave a talk and demonstration on "Voices Across Time and Space," showing how world-wide communications might be expanded by bouncing long distance telephone calls off satellites in orbit in outer space.

## **REGION F**

### **San Diego**

The April 19 meeting was held at the Sands Hotel on April 19. This was the last of the combined technical talk-popular tour programs for the 1960-61 season.

Following dinner, Captain Burl R. Bailey, commanding officer, Naval Air Station, Miramar, served as host for a tour. Development and operation of the jet station's radar air traffic control center were described at the dinner before the guests journeyed



to the station—now the biggest jet-fighter base in this country. The RATTC operations were observed close-up once the party arrived on board with both Navy and civilian controllers explaining step-by-step details.

The tour also included a look at the elaborate photographic laboratories and photo intelligence facilities, and inspection of latest model jet fighters. Newest fire-fighting equipment also was demonstrated.

The May 16 meeting was held at the San Diego Chuck Wagon. The program was provided by the Pacific Projects Office of the Navy Operations Development Force (OPDEVFOR).

#### San Francisco

Forty-five members and guests toured the new FAA Oakland Air Route Traffic Control Center, Fremont, Calif., on March 16. This installation is one of the most modern centers in

the country. The tour was preceded by a briefing given by assistant facility chief, J. O. Thomas.

### EUROPEAN REGION

#### Switzerland

A joint meeting of IRE and the chapter was held April 24 at the European Centre for Nuclear Research (CERN).

The guest of honor and speaker was Hurbert Leboutet, chief, Atom Department, Compagnie Générale De Télégraphie San Fil, Paris. His subject was "Construction and Performance of the 1 GeV Electron Accelerator of the Faculty of Science, Orsay."

Mr. Leboutet told the group that the Orsay accelerator, as first designed, attained, in December 1960, a maximum energy of 760 MeV, with 10 Klystrons of a final type installed out of 16. Its energy will be increased to

1 GeV when adjustment has been completed.

The first extension foreseen for the machine should increase the energy to 1.3 GeV by the addition of six new sections.

#### Tokyo

The April 14 meeting was held at the Sanno Hotel in Tokyo with 75 members and guests participating.

Speaker for the evening was Donald S. Parris, director, Electronics Division, Business and Defense Services Administration, U. S. Department of Commerce. He spoke on trends and outlook for the U. S. electronics industry.

Following the dinner, members made a night visit to the Tokyo Tower. Through the cooperation of the management guests were able to ascend to the 830 foot level (TV antenna platform) not usually open to the public.

## Association News

#### Telerad Division Joins Association

Telerad Division of The Lionel Corporation, electronics manufacturers, has joined the Association as a group member. Edgar A. Kiely, administrator, will serve as representative to the Association.

Named to membership are: Charles George, president; Stephen Lebo, plant manager; Peter L. Krohn, engineer; Walter Lupish, engineer; Harry J. Eyerman, project manager; Carroll J. Watkins, sales engineer; William W. McCaffery, sales engineer; Julius W. Kottke, engineer; George Hall, engineer; Richard Grovatt, project engineer.

#### Orbit Industries, Inc. New Group Member

The electronic development and manufacturing firm, Orbit Industries, Inc., Vienna, Virginia, has joined the Association as a group member. George W. Wall, Jr. is company president.

Named to membership are: Franklin C. Salisbury, board chairman; Philip M. Hunt, vice president, engineering; Philip F. Whitaker, Jr., vice president, military electronics; Chester Ellis, production manager.

#### New Group Member

Ingersoll Products, Division of Borg-Warner Corp., has joined the Association as a group member. The company is a manufacturer of metal modular enclosures. Donald Jones, product marketing manager, will act as company representative.

Others named to membership are: Edward P. LaKaff, chief engineer; Dwight Snow, chief draftsman; Richard Green, application engineer; B. A. Lucas, Jr., vice president in charge of

sales; J. Michael Votava, sales manager; Carl Peterson, division supervisor; Harold N. Bowen, sales supervisor; Herschel Wolfe, plant manager.

#### Special Award to AFCEA Group Member Company President

Dwight D. Guilfoil, Jr., president, Paraplegics Manufacturing Co., Inc., has received the Rehabilitation Award from the American Veterans of World War II and Korea (AMVETS) for his exceptional contributions in the field of rehabilitation of disabled persons. The award was presented at the Spring meeting of the AMVETS National Executive Committee on April 8 in Washington, D. C.

In part the citation reads: "The parable of the Good Samaritan holds eternal appeal because in our time no less than in the days of ancient Palestine moral principles must still compete with selfishness and heedless expedience."

"To incur the calculated risks of leaving the well-traveled road and, having done so, to succor the fallen

and the disabled when they have been spurned by others is as much an act of faith today as it was two thousand years ago.

"While this may speak poorly for ethical progress, there is comfort in the knowledge that the Samaritan has been remembered, that his example is still an inspiration to those among us who may cling to self-interest and conformity through fear of ever leaving the well-trod paths of least resistance."

"The analogy neatly describes the role of a modern-day Samaritan who has built a career out of personal assistance to many hundreds of seriously-disabled fellow Americans."

"As President of Paraplegics Manufacturing Company in Illinois, Dwight D. Guilfoil, Jr., has created a business dedicated to the employment of the severely-handicapped, to the development of their own self-confidence and to their ultimate placement through the acquisition of useful skills."

AFCEA profoundly congratulates Mr. Guilfoil for his dedication to the task of making life more meaningful for his fellow man.

Winners of AMVET Awards are (seated) Dwight D. Guilfoil, Jr., (standing, L to R) LeRoy Collins, Leo Hoegh and Bob Hope with Sen. Edmund Muskie of Maine, and Harold Russell, National Commander of AMVETS.





## NEW MEMBERS

Listed below are new members of AFCEA who have joined the Association during March and April. Members are listed under the chapter with which they are affiliated. Amateur radio operators are listed with their call letters.

### Alaska

Dale B. Bucknam  
Neal Eaden  
Leo W. Haagenson  
Homer M. Hare, Jr.  
Gordon H. Henning  
L. W. Honea, KL7DIF  
Ralph C. Johnson  
Karl J. Kura, Jr.  
Theodore L. Morris

### Arizona

Capt. F. J. Cataldo, USA  
Lt. Col. W. D. Lundy, USA  
Maj. E. J. Morgan, USAR  
Edwin N. Beckelhymer  
Robert E. Frese  
Franklin K. Glasier  
John H. Van Arsdell

### Atlanta

William P. Clopton  
Joseph B. Dillard  
J. N. Heape, Jr.  
Maj. F. J. Hilgersen, USA  
Sam W. Johnson  
Leon E. Kimmel, Jr.  
William B. Krueger  
Robert E. Lemon  
Charles E. Martin  
Wade L. Nelms, W4ZNY  
Fred B. Costan  
John O. Gilmore  
John R. McDaniel  
Jeannette L. Purcell  
Harold A. Rice  
W. F. Slate  
S. B. Spivey

### Augusta-Ft. Gordon

Dennis W. Adams  
2nd Lt. V. H. Brasher, USA  
Sgt. B. R. Brinson, USA  
M-Sgt. D. A. Bunyard, USA  
Capt. J. E. Cooke, USA, W4DCE  
SFC. R. H. Costello, USA  
S-Sgt. John C. Darcy, USA  
Alfred L. Dingler, USA  
M-Sgt. J. C. Domzalski, USA  
M-Sgt. R. L. Faist, USA  
Capt. F. S. Folk, USA  
SFC. S. M. Frase, USA  
Elmer F. Gahnz  
Joseph H. Gigandet  
Capt. R. Gilliam, USA  
Capt. C. L. Greene, USA  
Norman A. Hilbert  
2nd Lt. D. L. Hippensteel, USA  
M-Sgt. R. N. Hustead, USA  
1st Sgt. A. H. Jackson, USA  
1st Sgt. E. E. Kepler, USA  
Capt. J. B. King, USA  
SFC. E. D. Lynn, USA  
Capt. G. E. McDonnell, USA  
1st Sgt. R. E. Martin, USA  
1st Sgt. C. S. Nicholson, USA  
SFC. D. L. O'Leary, USA  
M-Sgt. R. C. Pruet, USA  
SFC. R. E. Rich, USA

1st Lt. T. W. Rossi, USA  
SFC. E. B. Sanders, USA  
2nd Lt. J. H. Schulte, USA  
1st Sgt. W. R. Settle, USA  
Maj. C. H. Shepherd, USA  
M-Sgt. C. W. Shinault, USA  
James L. Snell  
Lt. R. L. Strickland, USA  
1st Lt. E. E. Tabor, USA  
Capt. W. T. Vance, USA  
F. R. Van Laethem  
2nd Lt. C. B. Whiteman, USA  
M-Sgt. A. W. Wilkes, USA  
James M. Williams  
Chris G. Antonakos  
Winans E. Ash  
Jarrett A. Beck  
Capt. Jerome R. Behnke  
M-Sgt. E-7 Oliva B. Casper  
Fred L. Haskell  
S-Maj. Allen R. Kline  
Darold E. Plate  
S-Sgt. Olcott G. Mills  
Thomas J. Shaw, Jr.  
1st Lt. David L. Steele  
M-Sgt. Ralph A. Swenson

### Baltimore

Boyd R. Borrill  
Thomas E. Mansfield, Jr.  
Robert S. Stefan  
L. M. Smith

### Boston

Alan R. Alberts  
Maj. B. L. Dinardo, USA  
Harry F. Giberson  
Robert S. Phillips  
John Saulnier  
John L. Syman  
John Grady  
Paul M. Griffiths  
John J. Killelea  
L. H. Niemann  
A. H. Sandmann

### Cape Canaveral

Lt. Col. L. A. Breece, USAF (Ret.)  
Harry E. Coleman  
Harold L. Dillingham  
William J. Gebler  
Donald J. Gill  
Joseph Harris  
Robert R. Hogan, Jr.  
Elwood J. Rainwater  
John R. Borum  
Benjamin B. Brown  
John Cardoza  
Major C. C. Channel, USAF  
Lt. Col. R. C. Pagh  
Herschell R. Vaughn

### Chicago

Jimmie C. Allen  
Phillip M. Burnstine  
John T. Clark  
James E. Greek  
Maj. Z. S. Grzywnowicz, USA

Charles H. Haggerty  
E. Heitsch  
Theodore Hoffman  
Maurice Kalb  
Ernestine B. Kohn  
Lt. Col. B. P. Mauborgne, USA  
Maj. J. A. Navin, USAF (Ret.)  
John P. Nielsen  
E. Peth  
Joseph A. Sima  
W. P. Smith  
Stephan J. Bartha  
Harold N. Bowen  
W. H. Brandt  
H. A. Hubbard  
Richard Green  
J. Ingram  
Robert H. Jacobson  
Donald Jones  
Irving Koss  
Edward P. La Kaff  
B. A. Lucas, Jr.  
Carl Peterson  
Wilbert N. Petrucci  
Dwight Snow  
Harry K. Strauss  
William A. Taube  
James S. Taylor

### Cincinnati

Major George M. Hickman  
Glen B. Ransom  
Henry M. Williams, Jr.

### Dayton-Wright

Charles L. Backus, Jr.  
Arthur M. Bixby  
Eugene H. Fritschel  
Col. C. H. Shambeck, USAF  
James R. Brennan  
Howard Noyes  
Marlene P. O'Neal  
Richard J. Osgood

### Ft. Monmouth

William Camp  
Abraham E. Cohen  
Raymond C. Cruickshank  
Robert Eadie  
Richard J. Gale  
Horst H. Kedesdy  
William B. Lackey  
Maj. T. E. Maloney, USAR  
Emanuel G. Manuel  
John H. Michels  
Joseph A. Oliva  
Arthur H. Ross  
Darvey W. Wixon  
Harry P. Wooditt  
Mary Balkon  
Maxwell A. Brown  
Jacob H. Eggert  
Capt. John G. Eklund, USAF  
Victor L. Friedrich

### Frankfurt

M-Sgt. Lee E. Allen, USA  
Capt. Luther B. Smith

### Greater Detroit

Proctor G. Coates  
Richard I. Vanderhoff  
K. F. Umpleby  
W. H. Kraus  
SP-r C. N. Thompson, Jr.  
J. Jerome Williams

### Greater Los Angeles

E. W. Baker

A. H. Garry Gibson  
Anthony M. Johnson, Jr.  
Harold W. Jury  
John F. Kauwling  
Col. M. W. Kernkamp  
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C. G. Svala  
SP-5 J. E. Watson, USA

### Picture Your Idea in Glass

(Continued from page 31)

ceram's susceptibility to very fine grinding and polishing.

(5) The material is practically inert and is non-hygroscopic. It will not rot or burn. Once formed to desired dimensions, it will not change shape, bow or warp. (See Table 2.)

Allowable tensile working stress in Fotoceram is 3,000 pounds per square inch (three times that of Fotoform B and C). Most glasses are inherently weak under tensile loading, so wherever possible glass and glass-ceramic components should be kept under compressive loading, or at least within maximum safe tensile loading factors. Point loading should be avoided, especially at holes; so should sharp corners and small areas of contact with other components. Under specified test conditions that take tensile loading factors into consideration, Fotoceram articles have withstood low frequency vibration forces of 10 to 60 G's and high frequency forces well above 60 G's.

Stock thicknesses of Fotoceram range from .052 to .235-inch. Sizes 10 by 12 inches are not uncommon for printed circuit boards, and one

user's test board is 16 inches long.

These are some of the products made of Fotoform glass and Fotoceram: Insulators, tube spacers, attenuator plates, phase shifters, terminating stubs, fixtures for semiconductor devices, soldering jigs and masks for microminiature parts assembly and manufacture, printed circuit boards and component test boards, copper-clad grid boards for prototype work in circuitry, substrates for microminiature components and

electroluminescent devices, precision evaporating masks, dial-type instrument windows and scales, fine mesh screens, optical coding disks, honeycomb structures for lighting cells, light collimators, commutators, brush holders for digital converters, and laminated dielectric structures.

In short, most of the intricate flat substrates required for electronic applications can be produced in glass with photographic-etching techniques.

TABLE 2: Tolerances for Chemically and Physically Machining Photosensitive Glass

Dimension—± in inches	Fotoform	Fotoceram
Cut edge	1/16	1/16
Ground edge (standard)	0.005	0.005
(premium)	0.002	0.002
Etched edge 0 to 1/2 in. long	0.002	0.003
over 1/2 in. long	0.003/in.	0.005/in.
Hole ID, and slot length (or width)		
0 in 1 in.	0.003	0.005/0.007*
1 to 3 in.	0.005	0.010/0.015*
Hole spacing (center-to-center)		
0 to 1/2 in.	0.002	0.003
1/2 and over	0.003/in.	0.003/in.
Out of flat	0.002/in.	0.005/in.
Pattern concentricity		
exposed separately	0.006	0.006
exposed simultaneously	Same as hole spacing tolerances	

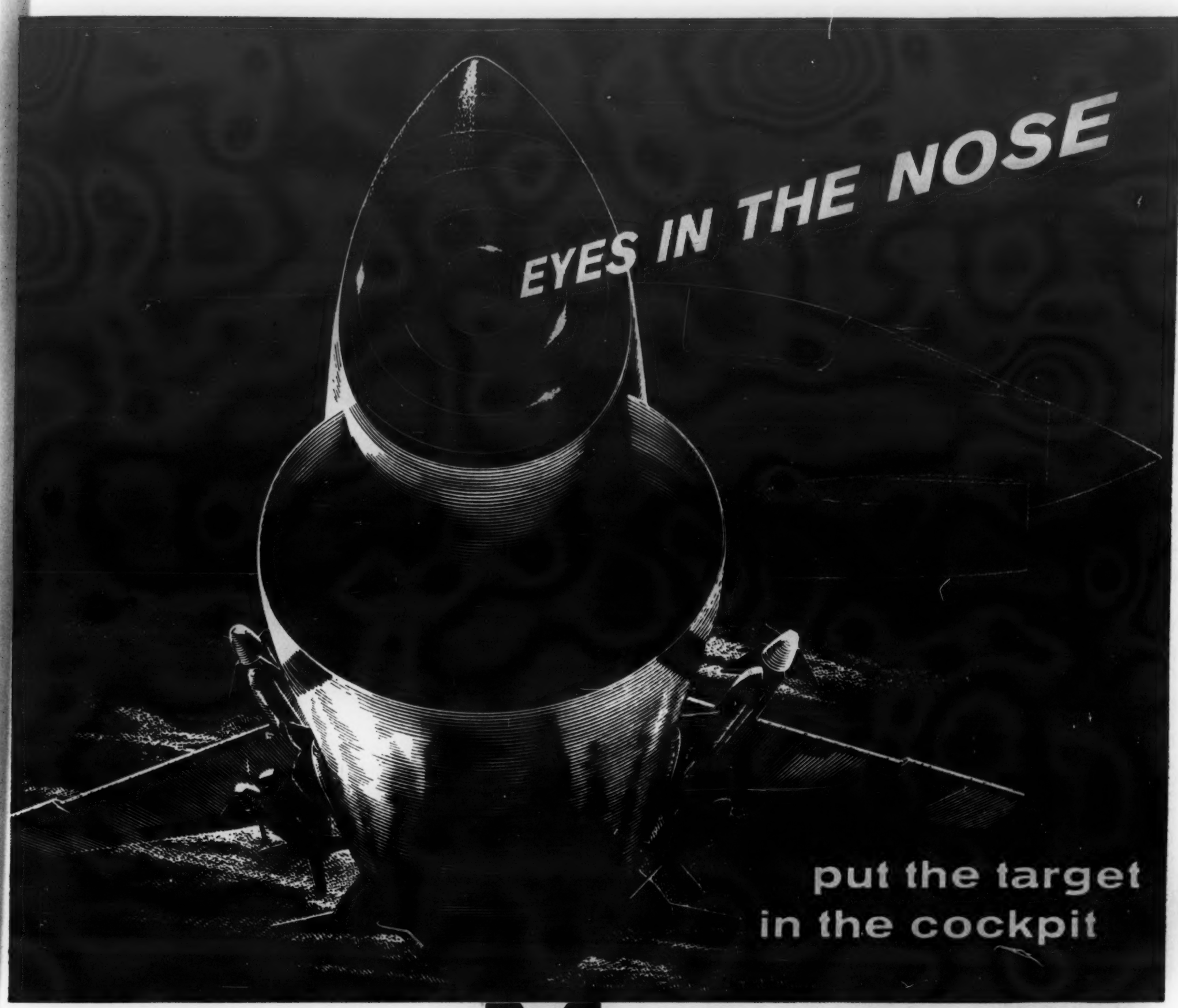
\*For glass thickness up to 0.080 in./for glass thickness over 0.080 in.



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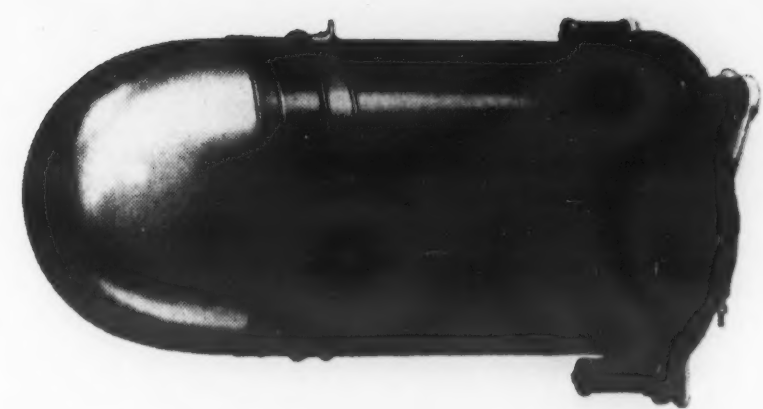


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As a result of development by the Magnavox Company in conjunction with the Navy Department, every Chance Vought F8U-2N Crusader Fighter Pilot sees the target at a glance — day or night, in any kind of weather.

Here are the eyes of a modern weapons system . . . a component that delivers the range, weight and reliability so absolutely necessary to successful tactical operations.

This airborne radar system is just one of many systems which have been and are being designed and produced to satisfy the tactical requirements of the military services in the fields of Communications, Airborne Radar, ASW, Navigation, Fusing and Data Handling.



**AIRBORNE FIRE CONTROL RADAR**

 <b>COMMUNICATIONS</b>	 <b>RADAR</b>	 <b>DATA HANDLING</b>	 <b>ASW</b>	 <b>MISSILES</b>
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**THE MAGNAVOX CO. • DEPT. 429 • Government and Industrial Division • FORT WAYNE, IND.**



# NEWS ITEMS AND NEW PRODUCTS

**Shipments of electronic components** increased about 4 percent during the fourth quarter of 1960—in sharp contrast to the 5 percent decline during the third quarter. The Electronics Division, Business and Defense Services Administration, U.S. Department of Commerce reports total shipments for the year were 10 percent over 1959 levels, reflecting the general increase in electronics activity.

The quarterly rise was due to increased requirements for military and industrial type electronic components. Shipments of consumer type components declined significantly.

Output of receiving tubes and television picture tubes, which are predominately used in consumer electronic equipment, declined 12 percent during the quarter while shipments of all other major groups of electronic components increased. The value of shipments of semiconductor devices increased sharply despite the continuing decline in average unit prices. Unit output of transistors increased over 30 percent although average unit prices declined over 11 percent.

Unfilled orders at the end of 1960 were about 5 percent above those of a year earlier and amounted to about 11 weeks' production at the fourth quarter, 1960 rate.

• • •

**Two engineers from the U.S. Army Signal Materiel Support Agency, Ft. Monmouth,** have received cash awards for engineering improvements in the Army's 26-pair field telephone cable. Theodore Malinowski and Howard Gold, the recipients, are both from the Agency's Field Engineering Division.

The new cable, called WM-130/G, costs a third as much as the cable it replaces, is about 35-percent smaller, about three times as strong, easier to produce, easier to use, lasts longer and provides higher quality transmission by reducing cross-talk.

U.S. Army Signal Training Command Headquarters reports the cable costs 24 cents a foot and is .625 inches in diameter. Because of its smaller size and weight, a 250-foot length can be rolled on a reel less than half the size the old cable required. Tensile strength was increased by including a steel mesh

armor around the outside and placing one steel wire in each conductor with six copper strands. The outside cover is polyvinyl chloride. Cross-talk was reduced by varying the intervals of twist of adjacent pairs of wires in the cable.

Use of the latex insulation of the conductors of the old WM-33/G cable restricted the manufacture of the cable to two companies licensed to use it. However, several manufacturers pooled their ideas to assist the Support Agency in developing the new cable which can be easily manufactured by a number of industrial firms.

Key to easy fabrication is the newly developed high-density polyethylene insulation on each conductor, now highly resistant to crushing.

A new coding system employing colored rings on each wire facilitates quick connection of the right pair of wires to complete a circuit. This eliminates the need for testing each individual circuit during installation.

• • •

**A radio research facility,** employing a 120 ft.-wide saucer-shaped antenna with a surface contour of high accuracy, is being built for the U.S. Air Force in Tyngsboro, Mass., for global and space studies. Construction of the \$3,800,000 research facility, which is scheduled to be operational by the end of 1962, is managed by the Electronic Systems Division at Hanscom Field. Lincoln Laboratory of M.I.T. is playing a major role in its design and construction and will operate and evaluate the facility for the Air Force.

The radio facility is designed to serve as a test-bed for development of the large, ground-based transmitting and receiving equipment that will be needed to operate high-capacity satellite-relay systems for transcontinental communications. The antenna, whose surface must never vary more than a thirteenth of an inch over its entire quarter-acre surface, will be sheltered by a new type of spherical radome 150 feet in diameter.

Radio equipment, including both the transmitter and receiver, will be mounted in a package unit on the antenna system, just in back of the center of the big dish, and will

move with it. Eight feet square and ten feet long, this unit is designed to hold two tons of electronic equipment for a particular experiment and can be quickly "unplugged" and another unit substituted for a different experiment.

This arrangement improves performance by eliminating long radio frequency transmission paths. These paths could be harmful by cutting down the transmitted power by introducing unavoidable losses at high power levels and could introduce noise that would impair the sensitivity of the receiver and its capability to detect faint incoming signals.

The first package unit will be 100,000 watt continuous-wave X-band transmitter (operating near 800 megacycles/second). It will be used in connection with a communication experiment nicknamed "West Ford." In this experiment metallic fibers will be placed in an orbital belt about the earth as a type of artificial ionosphere and radio signals reflected from them. Later equipment packages may contain low-noise receivers for radio astronomy purposes, short-pulse X-band radar and perhaps higher-power S or C-band transmitters and receivers.

The antenna system is being built by North American Aviation's Columbus, Ohio Division, while the radome contract is held by the H. I. Thompson Fiber Glass Co., Long Beach Division, Long Beach, California.

• • •

**Negotiations between the United States and Denmark** initiated over six years ago were recently concluded by the signing of an agreement between the two countries, in which the U. S. will provide international air traffic control services over the Danish owned Island of Greenland and its territorial waters.

Although military aircraft have been operating in the Polar Region since World War I, commercial aviation has only recently been able to realize the great savings in time and money through utilization of top-of-the-world air routes between the Far East, North America and Europe. Although the volume of air traffic through this 1,400 square mile Greenland area is small in comparison with that found in other areas of the world, it is sufficiently heavy and



complex enough to require the provision of an air traffic control service.

The USAF has been given the task of providing this service through USAF operated international Area Control Centers located at Sondre Stromfjord Air Base and Thule Air Base, Greenland. Communications supporting this effort will be a mixture of USAF and international aviation networks.

Scientists at the Naval Research Laboratory, Washington, D. C. have measured energy from Venus at the very short wavelength of 4.3 millimeters. They believe that this is the first time such measurements have been made.

Previous radio telescope measurements at wave lengths of about 10 centimeters and three centimeters have put Venus' temperature at 600°F, hot enough to melt lead. Later a temperature of 280° was recorded using radio waves 8.6 millimeters long. Analysis of the 4.3 millimeter measurements being made by C. R. Grant and H. H. Corbett of the Radio Astronomy Branch of NRL may help to resolve this question of Venus' surface temperature.

Measurements must be made at many wave lengths in order to obtain the spectrum of radio emissions. It is only by knowing this spectrum that scientists can decide among various possible radiation mechanisms. It is possible that the short, millimeter-length observations measure surface temperatures and that the centimeter-length waves measure the ionosphere of the planet. Under this theory, 600° would be the temperature of the solid surface and the lower temperature that of the cooler atmosphere. The temperature of the radiation-emitting source is inferred from the power of the noise received at any given wave length.

Harvard University, Graduate School of Business Administration, is providing a Management Development Program for military personnel. The sixteen-week course will run from August 28 through December 16, 1961 and will be repeated twice in the 1961-62 school year—in September and in February.

The program is designed for men in the 28 to 36 year age range. The curriculum includes four basic courses—General Management, Quantitative Analysis, Human Behavior in Organizations, and Leadership—which cover a broad range of management problems. In addition, there will be week-

ly seminars of particular interest to military participants.

The participants will study problems such as departmental planning, organizing work activities and appraising results against departmental objectives. "Cases" will be used extensively. The cases are actual management situations written by Harvard research personnel and encompass fields as diversified as finance, marketing, production, labor relations and industrial procurement. Techniques in basic accounting, the use of statistics, budgeting and forecasting will be taught. The Faculty of the Harvard Business School will also lead discussions in the problems of human behavior and human relations in organizations.

Inquiries should be directed to Dean Stanley F. Teele or Brig. Gen. John E. Murray, USAF (Ret.), Harvard Business School, Boston 63, Massachusetts.

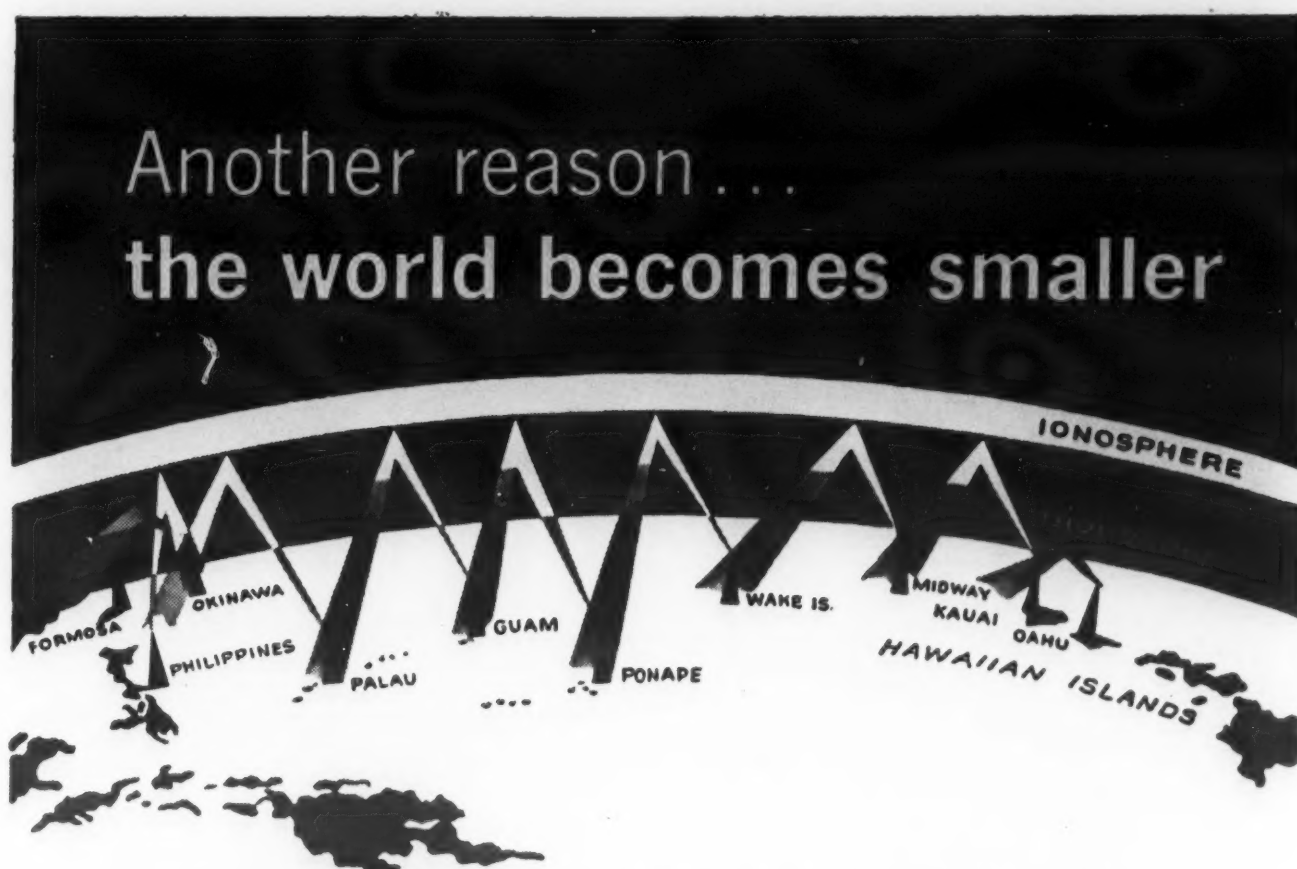
A one-week seminar on the management aspects of nuclear shelter planning for business, institutional and government executives will be held at the Pennsylvania State University on August 13-18.

Seminar sessions will not deal with the operational aspects of shelters,

but with the impact of shelter planning and construction on continuity of production facilities, planning, budgets and released management areas.

The seminar for business executives is being held on the recommendation of engineers and architects who attended the first seminars last summer on the planning and structural engineering aspects of atomic shelters. These seminars are being offered again this summer for architects and engineers with specific responsibilities for shelter planning and construction. A general corporate or governmental background is required for participation in the course. Specific knowledge of engineering or architectural aspects of shelter planning is not required. Further information on the program may be obtained from Shelter Research and Study Program, Hammond Building, College of Engineering and Architecture, Pennsylvania State University, University Park, Penn.

Electronic Engineers International is the corporate name for a team of electronics consultant engineers offering specialized coverage of four major European Technical Trade Fairs in May and June, 1961.



7,500-mile Pacific Scatter Communication System linking major command posts from Hawaii to Formosa was recently designed and built for the U. S. Army Signal Corps

by

**Page**



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aboard will be assembled for transmission  
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commands, and translates carrier  
frequencies for two-way Doppler velocity  
measurements. ☆ In laboratories and  
at launch site, Payload Test Sets will check  
out the spacecraft RF communications  
system. At NASA's transmitter and receiver  
sites, Calibration Beacons will check  
command transmitter performance and radiate  
precise signals to test telemetry receivers.  
☆ Motorola's participation in Ranger lunar  
probes demonstrates its space communications  
capabilities for frontier programs.

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The first fair of the series was the German Industries Fair in Hanover, April 30-May 9; followed by the "Mesucora" (Measurement, Control, Regulation and Automation) in Paris, May 9-17; the Instruments, Electronics, Automation Exhibition in London, May 28-June 2; and, the International Electronics and Nucleonics Exhibition in Rome, June 15-29.

The EEI team is made up of engineers who are native to the countries in which these fairs were and are to be held. EEI sifts through the products and technologies presented at the fairs; visits with the principals of the major European companies; attends all the important conferences; collects technical literature and samples; and then submits a comprehensive report for each fair, carefully cross-indexed for maximum utility.

Two types of coverage are being offered: one, with confidential, comprehensive reports covering the complete exhibitions and highlighting new developments. This costs \$400 for the package. The other plan which is open to a limited number of clients, is keyed to a specific area of interests, whether it be for an actual product, or for investment in a European firm, or for licensing, etc. This plan, which costs \$1500 for the four fairs, includes as well, all the material offered in the first plan, plus the specific investigations. EEI bases in England, France, Germany, Switzerland and Sweden are supplemented by the liaison function of its New York representatives at 85 Broad Street, New York 4, New York.

The Martin Company has been selected by the National Bureau of Standards as one of a number of companies to calibrate tiny electric cells for private industry and research laboratories. The company's Baltimore division will perform the calibration of unsaturated standard cells used in measuring accurately the voltage in an electrical system.

Proposed legislation to require all Federal agencies to take title to patents on inventions developed in performance of government contracts would give the government property for which it had not paid under conditions amounting to confiscation, Electronic Industries Association witnesses told the Senate Patents Subcommittee recently.

The electronics industry "with almost complete unanimity" opposes the legislation, declared Paul F. Hannah, vice president and general counsel of the Raytheon Co., and Elmer J.

Gorn, chairman of the EIA Patents, Copyrights and Trademarks Committee, in a statement prepared jointly for the association. The association spokesmen urged enactment of legislation reaffirming for all government agencies "traditional principles of private ownership of patents" with reservation to the government of royalty-free licenses.

The bills under consideration are S. 1084 and S. 1176 sponsored by Senators John L. McClellan (D., Ark.), the subcommittee chairman, and Russell B. Long (D., La.).

John M. Alden of Alden Electronic & Impulse Recording Equipment Co., Inc., recently presented to the Subcommittee of the U.S. Senate Appropriations Committee on Post Office-Treasury his company's plan for "Next-Hour" delivery of high priority mail, using facsimile techniques developed by the Westboro, Mass. firm.

Alden proposed to pay the Post Office Department for the franchise of having Alden's high-speed facsimile equipment installed in local post offices just as phone booths are installed now. Revenues to the Post Office could total \$1,000,000 the first

year and up to \$10,000,000 in subsequent years, Alden said. His company's investment in the project would ultimately total some \$30,000,000.

Alden pointed out that "Next-Hour" delivery utilizes proven equipment now standard on national Weather Bureau facsimile networks and is "in no way similar" to the system developed for the Post Office by ITT, called Speed Mail. The Alden system concentrates on the high priority mail (estimated at 1 percent of total mail volume), much of which may now be sent by special courier. Since it speeds decision making, cuts lead-times and increases capital turnover, Alden said, it addresses itself to the concern for the Nation's growth as well as lessening the problem of the postal deficit.

The company has designed new, high speed facsimile scanners and recorders capable of sending and reproducing graphic messages at 8 to 16 times present network speeds. The new units are designed specifically to take advantage of low-cost, broad channel communication links such as microwave and AT&T's "Telpak." Using a 19 inch-wide recording head, standard for weather maps and widely recognized as optimum for busi-

Another reason ...  
the world  
becomes  
smaller



A new Voice of America broadcasting facility in Liberia is being engineered by Page. Three previous VOA stations in Tangier, Okinawa, and the Philippines, bringing together over 100 nations, were designed and built by

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**AN ACHIEVEMENT IN DEFENSE ELECTRONICS**

## **New Transportable Radar Directs Precision Air Support**

Front-line ground forces can now obtain all-weather, close air support,—when and where needed—with the new lightweight AN/TPQ-10. This is the first helicopter-transportable, high-accuracy control radar for precision air support. Developed for the U. S. Marine Corps by General Electric's Heavy Military Electronics Department, the versatile new system can also provide aircraft control for emergency supply airdrops, paratroop placements and aerial mapping.

176-07

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ness use, the transmission time for two business letters or equivalent area is reduced from 8 to 16 minutes down to two letters per minute, Alden reports.

• • •

**A study to establish evaluation techniques and methods** for latest thermal design advances in airborne electronic equipment is currently in progress at Motorola's Military Electronics Division under contract to the Navy Bureau of Weapons. The work is being done by the Mechanical Engineering Laboratory of the Division's Western Center in Scottsdale, Arizona.

Bureau of Weapons has received a preliminary draft of a proposed military specification incorporating recommended design evaluation techniques. Tests of representative equipments will begin soon. The results of the test phase, together with data from the initial study phase, will then be combined to establish the actual techniques and methods.

• • •

**International Business Machines Corporation** formally dedicated its new Thomas J. Watson Research Center in Westchester County, New York, during the annual stockholders meeting recently. Designed by Eero Saarinen, the building will house 1500 scientists and supporting personnel. The crescent-shaped structure stretches 1,091 feet along the northern slope of a hill near the Taconic State Parkway.

Before undertaking the design of the Center, Saarinen spent weeks observing researchers at work in order to see how they moved around a room and how they used their equipment. He noticed that most researchers sat with their backs to windows and kept Venetian blinds drawn. This observation led him to the design of windowless offices only a step from the radial aisles and a few feet from the wide vistas of the glass-walled main corridors.

Mock offices were constructed in other IBM laboratories and tested through actual use in advance of construction. The modular units are complete with built-in metal cabinets, closets and shelves. Even the color scheme of the enamel surfaces was tested for the reaction of scientists using the offices.

Almost all the classical science disciplines will be represented in the new Center. Among the central areas of interest are solid state physics, chemistry and mathematics. Some of the other disciplines—biophysics, information retrieval and linguistics,

for example—are characteristic of the new uses being developed for data processing.

The Center becomes IBM's largest research installation and will act as a national and international clearing house for new thinking in computer science. The Center is headed by Dr. Gilbert W. King, IBM's Director of Research. A number of projects are already under way at the new Center. First shown at the dedication was a new light detecting device which can aid in evaluating data from an orbiting satellite. The device is the heart of a system that determines the direction in which the satellite's instruments are pointed. Called the "Moonlight Photodetector," the device is ten times as sensitive as silicon solar cells and other similar semiconductor light detectors, and has a silicon surface smaller than a pinhead. It is sensitive enough to detect very weak light rays from the moon, yet rugged enough to withstand intense direct sunlight and firing of the satellite vehicle into space. The photodetector requires so little power that a 1.36 volt battery the size of a penny can operate it for several years.

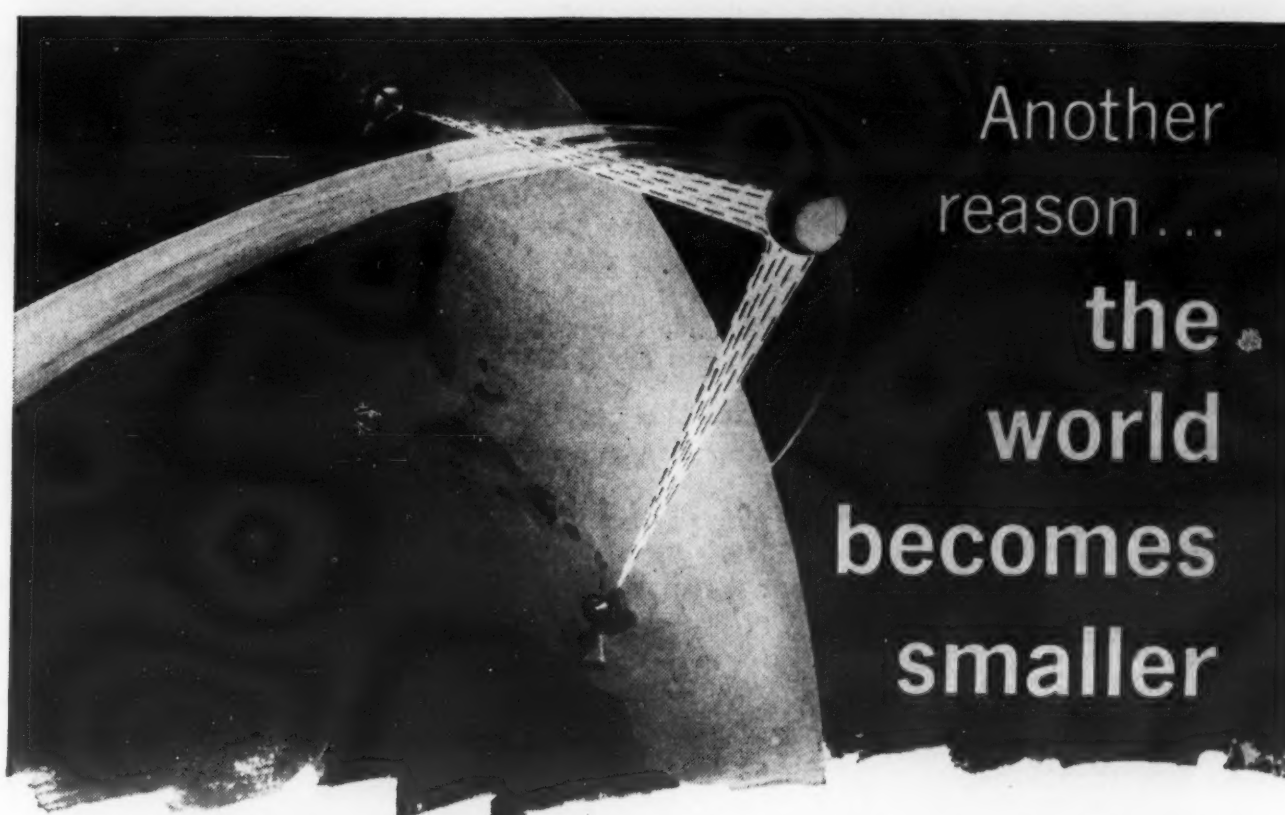
Representative of a trend to automate the task of taking research data

is an installation for checking the characteristics of solid-state materials. This device makes a series of runs on several material examples automatically. The output is a stack of punch cards suitable for computer analysis or tabulation. The equipment has greatly speeded the taking of data, reduced errors and released skilled personnel for more important work.

• • •

**A method of producing synthetic speech** in response to the typing of phonetic symbols on a keyboard was demonstrated at a meeting of the Acoustical Society of America last May by Bell Telephone Laboratories' scientists. Doctors John L. Kelly, Jr., and Louis J. Gerstman played several tape recordings of speech which had been synthesized by an electronic digital computer.

Dr. Kelly explained that he and Dr. Gerstman had proposed a "speaking machine" of the tandem resonant type in which novel principles are used. Before actually building it, they used a high-speed, general-purpose computer to simulate it. The computer is programmed to accept in sequence on punched cards the names of the phonetic speech sounds



An experimental satellite communication relay being designed and engineered under cognizance of Rome Air Development Center will transmit voice and teletype 2000 miles through space via a passive orbiting satellite. Stations will be at Floyd, N.Y. and Trinidad.

**Page**  **COMMUNICATIONS ENGINEERS, INC.**

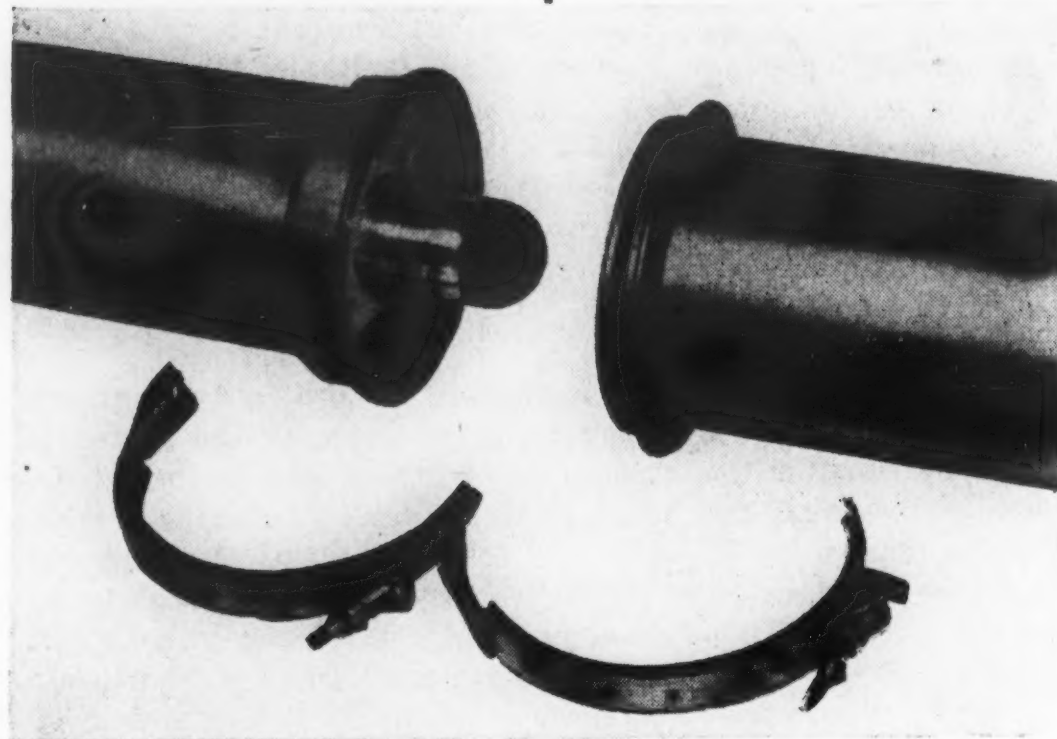
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- Notable for their proven low-noise connections

### TYPE 40 QUICK-CLAMP LINE

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- piloted flanges that eliminate the need to align the outer conductor by centering rings or other devices

A captive O-ring for sealing not only provides a perfect gas seal, but renders damage or jamming during assembly virtually impossible. Electrical contact is dependent only on tightening the clamp.

### TYPE 70 EIA (RETMA) LINE

When specifications stipulate an EIA (RETMA) bolted-flange line, DIELECTRIC Type 70 offers the same electrical properties as the Type 40 line. Positioning of line sections during installation is made accurate by alignment pins. An O-ring placed between the flanges is provided for gas sealing.

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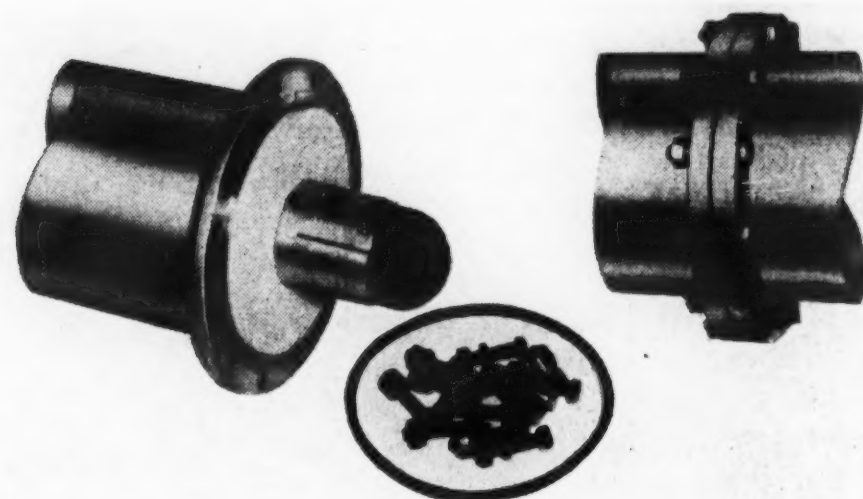
Standard sizes:  $\frac{7}{8}$ ,  $1\frac{5}{8}$ ,  $3\frac{1}{8}$ ,  $6\frac{1}{8}$ ,  $9\frac{3}{16}$  inches

Special sizes: 9, 10, 12, 16 inches

Any length up to 30 feet

All standard impedances from 25 to 200 ohms

Copper or aluminum outer conductors



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Prompt shipment of standard lines and components is usual because a large stock of manufactured parts is maintained for fast assembly. And in addition, DIELECTRIC'S complete r-f laboratory and production facilities are available for the design and manufacture of other lines and components for special requirements.

For more detailed data on the above lines and their components, write for Catalog 61-4. Also, DIELECTRIC designs, develops and manufactures a wide range of components and equipment for the communications industries. If you'd like to know how we can help you solve a problem in this field, simply dial DIELECTRIC.

\*For applications in the broadcast and television field, transmission line products are available from the Radio Corporation of America. For other applications, contact DIELECTRIC directly.

DIELECTRIC'S areas of capability include coaxial, waveguide and open wire techniques . . .  
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which make up an English sentence. The computer then processes this information the way an actual speaking machine would, and produces an output like the output of the speaking machine.

The program has two parts. One simulates the speaking machine; the other consists of rules, derived from previous research, for combining the individual speech sounds into connected speech and producing control signals for driving the speaking machine.

Nine control signals corresponding to voice pitch, buzz intensity, hiss intensity, plus the center frequencies and bandwidths of three speech formants, are continuously generated. The speech of the simulated talking machine comes out of the computer on digital magnetic tape. It is then converted to a variable magnetic sound track suitable for playing on an ordinary tape recorder.

• • •

An all solid-state dc to 100 mc general purpose universal counter-timer has been developed by Computer Measurements Co., Sylmar, California.

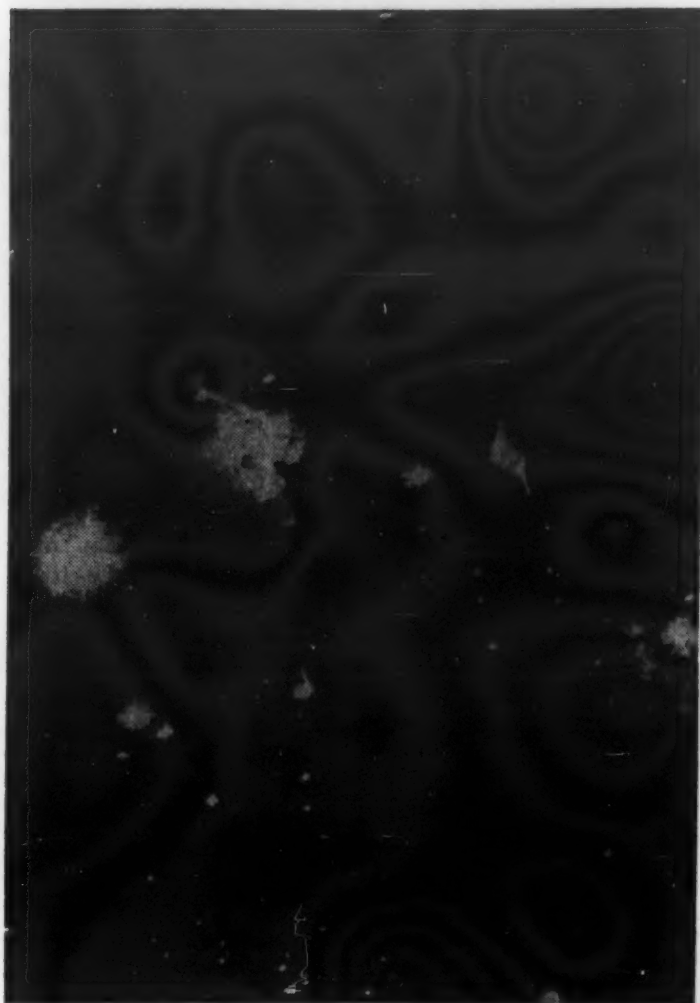
The Model 728B now in production measures and displays frequencies directly without heterodyning techniques from dc to 100 mc, measures time intervals and period to  $10^{-8}$  seconds and counts at rates to 100 mc with self-contained time base. Paired pulse resolution is 10 nanoseconds and accuracy is  $\pm$  count  $\pm$  oscillator stability (short term: 2 parts in  $10^8$ ; long term: within 5 parts in  $10^8$ ).

• • •

An instrument that removes major forms of distortion in video transmission has been developed by Telechrome Manufacturing Corp., Amityville, N. Y.

The equipment, known as the Time Domain Equalizer, Model 20/20, is designed to correct waveform defects in any television, radar pulse, sine wave or wide-band complex waveform signals. The equipment utilizes the "paired echo" principle in which any waveform is considered as the resultant of several paired echos, each a replica of the signal, but advanced or delayed in time. Correction of waveform defects is accomplished by synthetically generating echos from the distorted waveform itself and adding these in the proper amplitude and phase to the main signal in order to cancel out the unwanted portion of the signal.

(Continued on page 66)



who's out there?

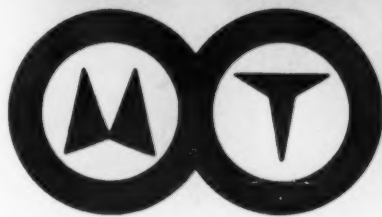
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Helping "man" the missiles at the Vandenberg Air Force Base is a new 3500-line automatic telephone intercommunications network installed by AE.

Advanced switching techniques permit this exchange to set up any desired combination of conference or command circuits in a matter of seconds, provide taping of conversations, and interconnect with outside lines via microwave.

Complex circuit routing such as this is not new with us—AE has had a hand in the development of specialized communications systems for the armed forces for over 50 years.

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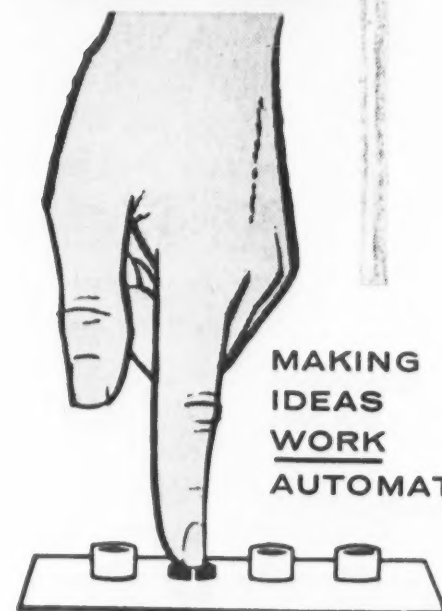
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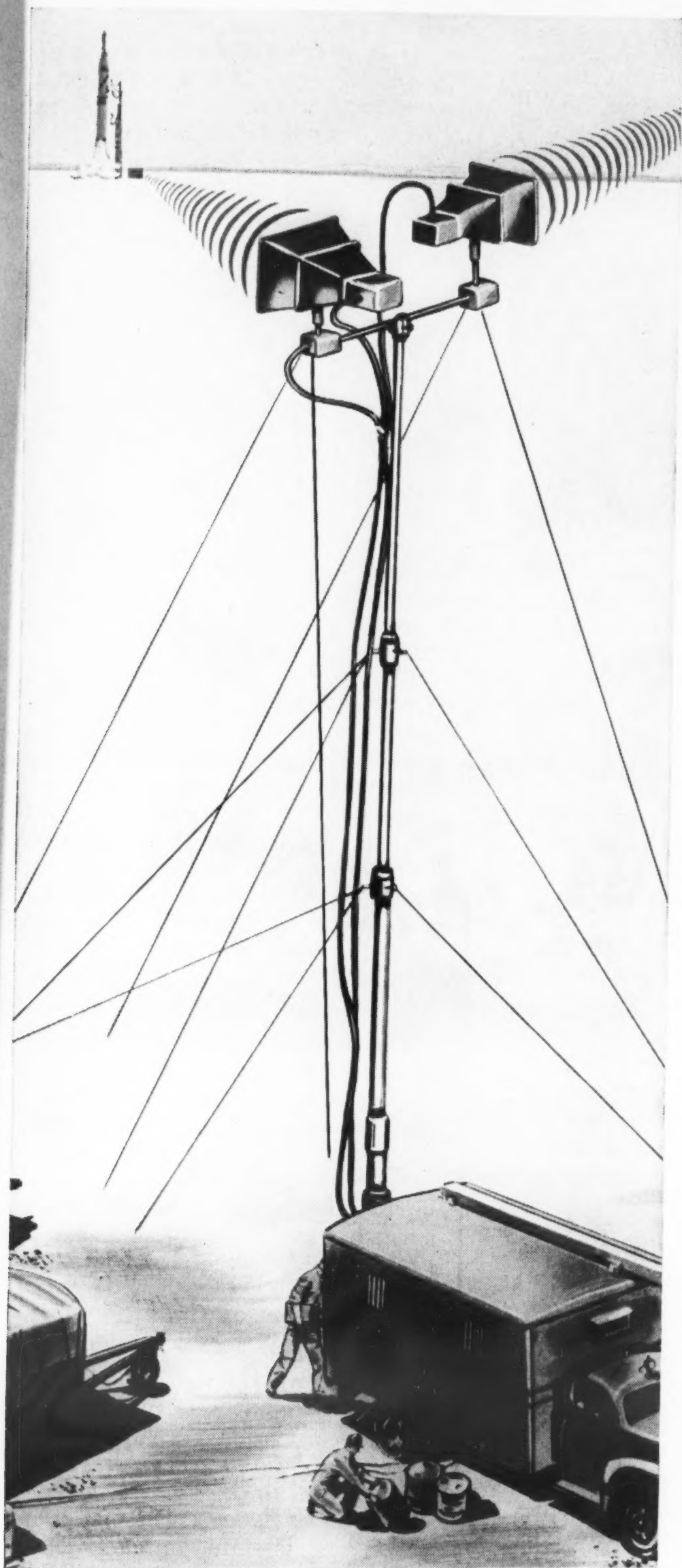


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In addition, the Model 28 ASR comes equipped with a "big plus"—the Stunt Box, a built-in programming mechanism that offers an inexpensive solution to a wide variety of remote control and switching tasks, such as automatic station selection and telemetering.

All of these facilities are available to you in a compact console measuring approximately 39" high, 36" wide and 23" deep.

Teletype Corporation manufactures this equipment for the Bell System and others who require the utmost reliability from their data communications facilities. Teletype equipment can be used with Data-Phone and other communications services.

For a free brochure on the Model 28 ASR, write to Teletype Corporation, Dept. 76F, 5555 Touhy Avenue, Skokie, Illinois.

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For television transmission applications, the instrument provides facilities for generating echos up to 0.75 microseconds ahead of the actual signal and for 1.5 microseconds following it. Other ranges of echo times can be provided on order. Suitable controls are provided for generation, at will, of very small incremental echos in time, amplitude and phase. These incremental echos may be added directly to correct any defect in any signal. Mid-frequency and low frequency corrections are accomplished by appropriate equalizers.

• • •  
Taber Instrument Corp. has introduced a miniature transducer designed for airborne applications involving the precise electrical measurement of fluid and gas pressures up to 200 psia or psig.

Called "Teleflight" Model 183, the device is built to withstand the severe accelerations and vibrations encountered during missile and rocket flights, while maintaining a pressure measurement accuracy of 0.25 percent over a wide temperature range.

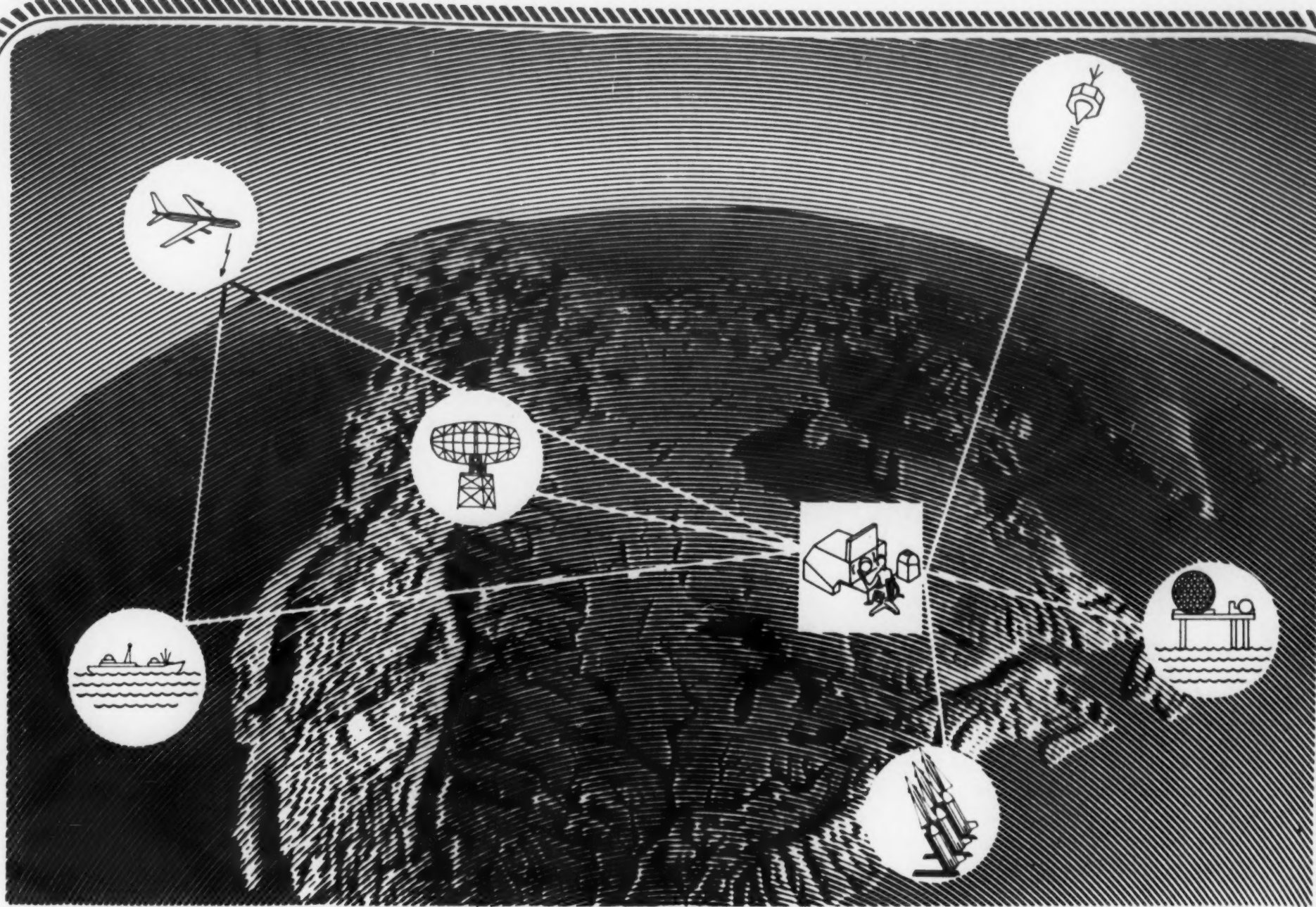
The measuring element is a one-piece, Ni-Span-C proving ring to which are bonded 4 precision strain gages, forming a Wheatstone Bridge. Under zero gravity conditions, when convention cooling ceases to function, the proving ring acts as a heat sink in conducting heat from the resistance wires to the instrument case. Metal diaphragms separate the pressure cavity from the measuring chamber.

• • •  
Three types of small radiation source machines will be marketed by Hughes Aircraft Company. They include a monopulse linear accelerator, capable of producing high intensity gamma radiation in short pulses and in size, no larger than an office desk; a steady-state "linac" of similar compactness and output, and a small cyclotron.

• • •  
Two pamphlets now available from the Office of Information Services, Patent Office, U.S. Department of Commerce, Washington 25, D. C., are *Obtaining Information from Patents* and *Answers to Questions Frequently Asked About Patents*. The first publication contains information as to obtaining patents, searching and the many services of the Patent Office. The second bulletin contains answers to forty questions about patents most frequently raised by inventors and businessmen.

The following publications are available from the Office of Technical





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As Technical Advisor to the United States Air Force, a primary concern of The MITRE Corporation is to help provide optimum command and control systems. Working closely with the Air Force Electronics Systems Division, MITRE is active in such programs as:

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- NORAD Combat Operations Center (425 L)
- Strategic Air Command and Control System (465 L)
- Intelligence Data Handling System — high-speed processing of world-wide information (438 L)
- SAGE Air Defense System (416 L)
- Extension of DEWline (413 L)
- Weather Observation and Forecasting — a global semi-automatic electronic system (433 L)
- Electromagnetic Intelligence System — a world-wide system (466 L)

As a system engineering organization, MITRE provides technical guidance in the advanced design, development and evaluation of these systems. The work requires close liaison—but not competition—with other scientific groups and with industry.

In conjunction with its system work, MITRE conducts a supporting program of research and experimentation in electronic command and control technology.

MITRE was created as an independent corporation in 1958. Its charter restricts its work activity to engineering and scientific services to agencies of the United States government. The company cannot issue stock nor make a profit. Its highly competent Technical Staff works in an atmosphere conducive to free inquiry and complete objectivity.

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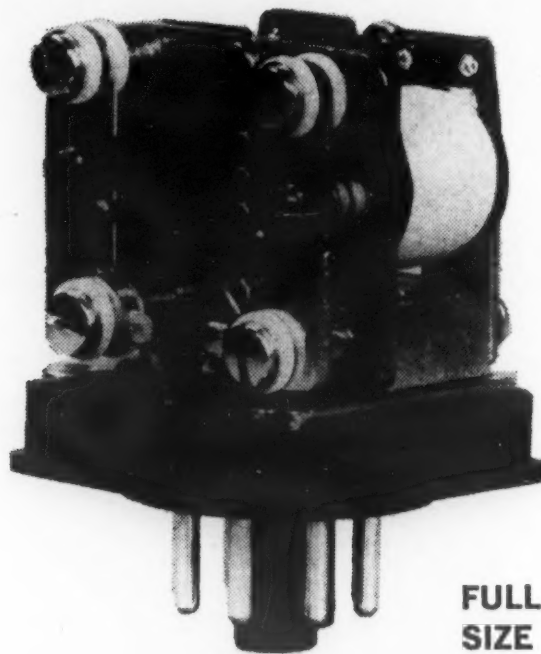
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Services, Business and Defense Services Administration, U.S. Department of Commerce, Washington 25, D. C.

*Second Status Report on Fuel Cells* by Office of the Chief of R&D, U.S. Army, Order No. PB 171-155 for 75 cents, reviews progress in military fuel cell R&D covering the period June 1959 to present.

*Power Requirements for Space Communications* by Sandia Corporation for U.S. Government, Order SCTM 179-60(51) for 75 cents, investigates the factors affecting the choice of a space communication system with particular emphasis on power. Power requirements for an ideal communication system are discussed and various specific types of systems are compared with the ideal.

• • •

A report on Communist Chinese professional manpower and education, released recently by the National Science Foundation, sees that country's scientific effort geared to meet immediate technological demands, its education undergoing rapid change and expansion, and its development as a major industrial power handicapped by its population problem.

*Professional Manpower and Education in Communist China*, by Leo A. Orleans, senior research analyst, Library of Congress, is an assessment of often confusing and contradictory data reported by Communist and other sources. From this analysis emerges a picture of impressive national progress toward increased industrial productivity through a massive education and manpower training effort.

Dr. Alan T. Waterman, director of the National Science Foundation, called the report, "a pioneering effort in a field made difficult by limited availability of reliable source material. Communist China's scientific and technological capabilities cannot be properly evaluated without detailed assessment and full understanding of its professional manpower and education. I hope this report will encourage further study of this very important field."

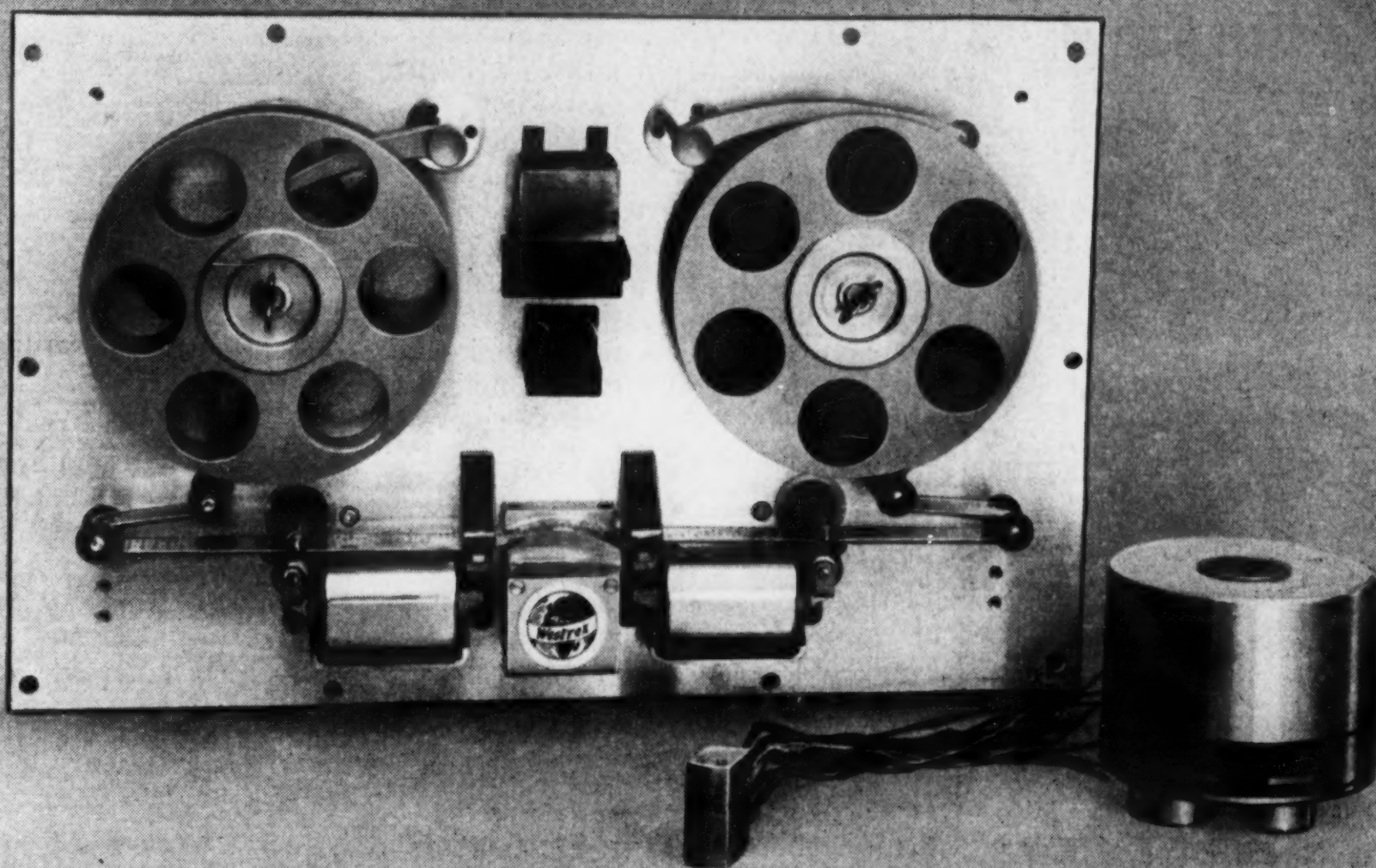
The report was prepared under a Foundation grant to the Library of Congress, and is the result of two years of analysis and evaluation of material on mainland China.

• • •

*National Bureau of Standards Miscellaneous Publication 233* is now available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C., for 40 cents per copy. The publication, *Units of Weights and Measures (U.S.*



**A WESTREX BRIEFING...** To your specifications for recording, storing, and recovering data, Westrex brings more than a quarter of a century of experience. Our major disciplines are (1) electronics, (2) mechanics, as needed in mechanical design for precise tape-pulling mechanisms, and (3) optics. Here, briefed, are descriptions of some of our new products...



**PERFORATED TAPE READERS** A new Westrex perforated tape reader handles 8 levels of information; reads in both directions at continuous speeds up to 1400 characters per second; stops on character at 200 characters per second. Starting time 22 milliseconds, stopping time 1 millisecond. Remote control operation and logic level output to meet your specific needs. Solid state electronics, with miniaturized etched circuit, plug-in modules. End of tape sensing by logic read out.

**MAGNETIC HEADS** These include multiple section instrumentation heads; memory drum heads; and erase-record-reproduce assemblies for applications that range from sound systems to missiles. Catalog items or custom-built units to your requirements. Our experience assures proper utilization of design factors that most economically meet your needs. Consideration of your special requirements, such as high crosstalk rejection, stability under extreme environmental conditions, and precise mechanical tolerances, are a part of our service to customers. What are your needs?

#### **MINIATURE AIRBORNE TAPE RECORDERS**

Designed to withstand impacts of 1500 G's, a new Westrex miniature recorder can simultaneously record and monitor 14 tracks of information. With 14 tracks to the inch, unique shielding provides a crosstalk ratio of over 40 db at 5000 c.p.s. Precise gap alignment, obtained by optical lapping methods, maintains gap scatter within plus or minus 50 microinches. The positively-driven tape-pulling mechanism, and virtually continuously supported tape, are features which reflect our unique and proprietary knowledge in this field. The entire hermetically-sealed recording unit is contained in a single cylinder 3 inches high and 4 inches in diameter.

For information on this and other Westrex products, address your inquiry to Westrex Company, Recording Department, 6601 Romaine Street, Hollywood 28, California.

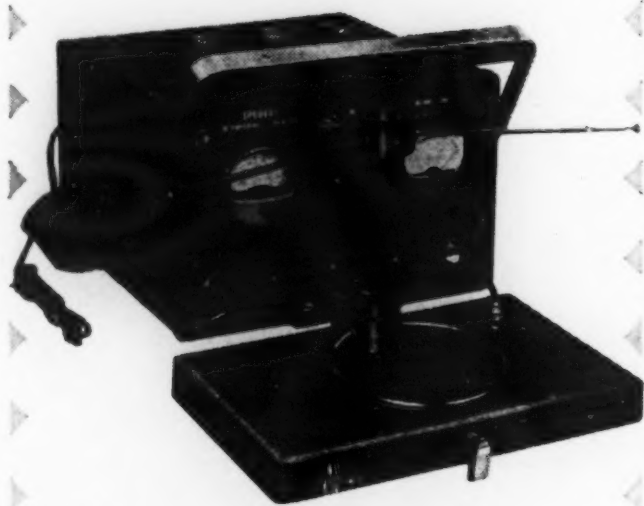
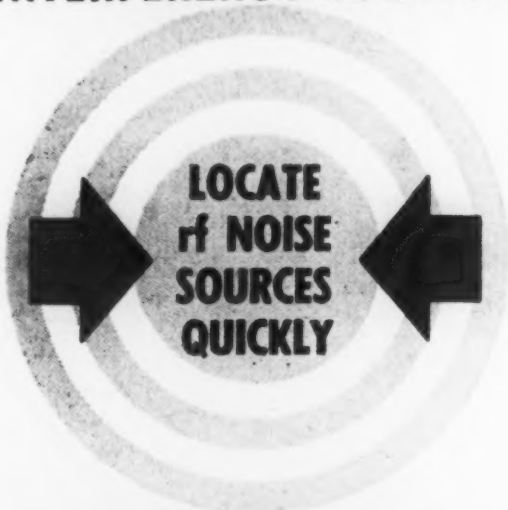
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*Customary and Metric*)—*Definitions and Tables of Equivalents*, was issued December 20, 1960.

A 1959 agreement among the directors of National Standards Laboratories of English speaking nations to obtain uniformity in precise measurements involving the yard and the pound have brought about refinements in the definition of the U.S. customary units of length and mass, and have made this revised edition desirable. The units of length, area, volume, capacity and mass in the U.S. are defined in conformity with the 1959 agreement and the tables of interrelation and tables of equivalents for these units in the metric system and in the U. S. customary system have been recalculated by automatic computer.

Further revisions include the deletion of the table showing interrelation between bushels and hectoliters and the addition of a more complete table showing the equivalents of inches in millimeters.

**Guide to In-Circuit Semiconductor Testing**, by Bernard Reich, President of Molecular Electronics Inc., is available from Molecular Electronics, Inc., 87 Weyman Ave., New Rochelle, N. Y.

The publication discusses requirements of in-circuit testing, with particular application to diodes, rectifiers and transistors. Described are some of the requisites of in-circuit testing, including a consideration of semiconductor types, their electrical and mechanical considerations, desirability of measuring operable as well as defective types and the self sufficiency of the testing unit.

### Photoprogress

Various techniques to increase the usefulness of the sweeping-image smear camera in detonation and shock dynamics research are described in a Navy research study released through the Office of Technical Services, Washington 25, D. C. Also available from OTS are two other optics research reports on the change in apparent image size caused by motion during photographic exposure and, *Steel Mirrors for a Streak Camera*.

*Smear-Camera Techniques*, Order No. PB 171-352, is available for 75 cents; *The Change in Apparent Image Size Caused by Motion During Photographic Exposure*, Order No.

PB 171-385, is available for 50 cents; and, *Steel Mirrors for a Streak Camera*, Order No. PB 171-191, may be obtained for 50 cents.

A lunar atlas, compiled from the first photographs taken of the far side of the moon, with detailed descriptions of its newly-revealed portions as interpreted by Soviet scientists, has been released through the Office of Technical Services, Business and Defense Services Administration, U.S. Department of Commerce, Washington 25, D. C. Compiled and published by the USSR Academy of Sciences, the atlas is available in English through the cooperative effort of the Office of Technical Services and the U.S. Air Force.

*Atlas of the Far Side of the Moon* is available from OTS for \$3 per copy, order No. 61-21955.

**A Ballistic Camera Synchronization System** designed cooperatively with the Army Ordnance Ballistic Research Laboratories and developed and manufactured by the Electronic Engineering Company of California, Santa Ana, is capable of synchronizing Ballistic Cameras with rotating shutters to within one ten-thousandth of a second. The cameras for tracking space vehicles or capsules may be located as much as 200 miles apart and still retain this accuracy. Depending on the quality of the communication link, considerably larger base lines are possible without much loss of the precision in the synchronization, EECO reports.

The system is housed in three trailer vans. The vans contain one central camera control and two remote control timing stations. The cameras are interconnected by voice-quality radio or telephone circuits.

**Electro-Optical Instruments, Inc.**, of Pasadena, California, has introduced a new Kerr Cell Instrumentation Camera System, model KSC-51A. A trigger pulse generator has been added to the control unit circuitry of the present KSC-51 model.

The pulse generator permits operation from an external low voltage trigger source, as well as from an internal 60-cycle source. The trigger pulse generator has three output pulses with the following characteristics; a 50-volt pulse from a high impedance source which can be utilized to provide time-base generation; a fixed 300-volt pulse which provides Kerr cell triggering action into a





Hardly larger than cigarette packages, wire spring relays form the heart of switching apparatus for more than 200-million telephone calls a day. The pencil indicates the top row of tiny palladium-capped contacts which are vital to the relay's switching functions.

## Probing for palladium via thermoelectricity

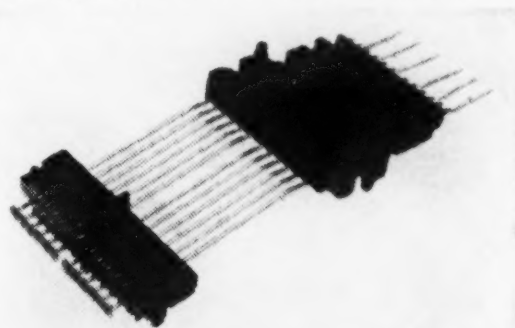
Wire spring relays are vital to the Bell Telephone System's reliable, high-speed switching equipment.

Western Electric will manufacture more than 13 million relays in 1961. Palladium-capped contacts on these relays are necessary for their optimum performance—therefore, positive verification of the palladium is essential.

Verification by existing means has proved to be extremely difficult, however, because of the caps' size (only 0.01 x 0.073 x 0.042 inches) and the fact that the palladium and the cupro-nickel base blocks to which the caps are welded are similar in color, making visual checking highly unsatisfactory. Also, the characteristics of the metals involved make ordinary electrical and magnetic methods impractical.

To overcome this problem, Western Electric engineers have developed and built an ingenious machine which utilizes the Seebeck thermoelectric effect, by which an electrical circuit made up of two different metals generates an electric current when the junction between the two metals is heated. In this case, nickel and palladium were the metals involved, but another feature of the Seebeck effect is that a cir-

cuit composed of nickel and cupro-nickel generates a current *which flows in the opposite direction*.



The single wire block — a component of the wire spring relay — showing the cupro-nickel contact points, some of which must be capped with palladium.




Contact verification machine, developed and built by Western Electric, being programmed to check wire blocks for dielectric breakdown, physical configuration, and palladium contacts.

The engineers made use of this feature by using nickel probes — preheated to 300 degrees Fahrenheit — in the new machine. The probes touch all contacts on the relay's single wire block assembly, and the *direction* of the current produced indicates whether the probe has contacted palladium or the cupro-nickel base metal. Amplifier circuits enable the "indicator" currents to operate automatic controls and automatically reject defective assemblies.

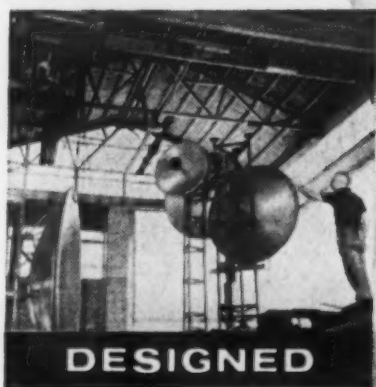
Being able to intentionally leave caps off certain pre-selected contacts is also a prime advantage of this new verification process, since hundreds of thousands of relays use less than the maximum number of contacts. Savings in material costs, which are made possible by omitting precious palladium from unused contacts, are significant. But the most important advantage of the process is the proven ability to produce a product with verified quality — the kind of quality required by the Bell System's twenty-three local telephone companies to give highly dependable telephone service.

**Western Electric**

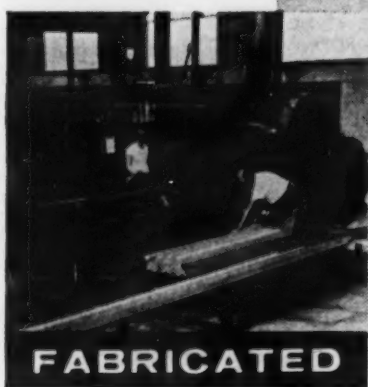
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50-ohm load; and a 100 to 300-volt variable output pulse which is available for initiating other phenomena or instrumentation.

• • •

**The Photographic Flight Analyzer** developed by Fairchild Camera and Instrument Corp., Industrial Products Division, is a portable precision tracing device operated manually by one person to record the space trajectory of a moving object on film. It reportedly tracks moving objects at high azimuth rates and is in use by the U.S. Signal Corps, Drone Test Facility in Yuma, Arizona; U.S. Air Force Test Station, Edwards AFB, California and the National Aeronautics and Space Administration at Langley Field, Virginia.

• • •

**Bausch & Lomb** is planning to market a 120-degree mapping projector. The Balplex 120 is portable and is designed for use either in headquarters or mobile, field units. Bausch & Lomb has designed and built the entire Balplex, including the special glass used in the optical system. The lenses reportedly have extremely high resolving power and are uniform in the distribution of light intensity.

• • •

A new type vidicon broadcast TV film camera with high picture resolution is being manufactured by the Vicon Division of American Microwave & Television Corporation.

Designed for maximum horizontal resolution, gray scale response and linearity, the new camera (Model V-900) provides the broadcaster with film reproduction of 800-line horizontal resolution in the center and 600 lines in the corners. Response is 50 percent at 800 lines and 75 percent at 600 lines. Maximum stability is provided by electronic regulation of all voltages, including camera filaments.

• • •

**The Sentinel III Camera**, developed by OPTOMECHANISMS Inc., L. I., N. Y., is a 35 mm recording type for cine or pulse operation. The camera consist of four separate packages in a modular type construction: the Camera Body, the Magazine, the Drive Motor Package and Data Box. Electric operation permits synchronized and remote control between two or more cameras. The camera can be adapted to long focal length lenses and the magazine can be adapted to specially designed camera bodies.

## Names in the News

**Peter J. Garrini** heads the new company, Peter J. Garrini & Associates Ltd., 120 High St., Edgware, Middx., England. The company provides sales consultants in the export markets.

**Dr. James E. Storer** has been named acting director of the Applied Research Laboratory of Sylvania Electric Products Inc.

**William L. Reynolds** has been promoted to vice president of Litton Industries, Inc., and president of Litton International, S. A., and Litton World Trade Corp.

**Brig. Gen. George W. Goddard**, USAF (Ret.), has been named special assistant to the president, Itek Laboratories.

**Leslie H. Warner** has been elected president of General Telephone & Electronics Corp.

**James J. Clerkin, Jr.** has been elected president of General Telephone & Electronics International Inc.

**R. L. Beam** has been elected an executive vice president of Hazeltine Corp.

**RAdm. William L. Freseman**, USN (Ret.), has been appointed to a new post of assistant to the president, Radio Engineering Laboratories, Inc.

**Dr. Wolfgang W. Gaertner** has been promoted to vice president of the new Solid State Physics Branch of CBS Laboratories.

**Myron Newberger** has been named executive vice president, Avnet Corp.

**Sol M. Linowitz** has been elected chairman of the Board of Directors of Haloid Xerox Inc.

**Winfield E. Fromm** has been appointed director, Research and Systems Engineering Division, Airborne Instruments Laboratory, a division of Cutler-Hammer, Inc.

**Edwin D. Campbell** has been elected to the new office of vice president and general manager, Laboratory for Electronics Inc. **David A. Stuntz** has been promoted to corporate treasurer.

**Dr. Nicholas A. Begovich** has been appointed a vice president of Hughes Aircraft Company.

**Ernest G. Loeb**, president of Chicago Aerial Industries, Inc., died on April 20 after a brief illness.

**Charles H. Percy** has been elected chairman of the board and chief executive officer of Bell & Howell Co. **Peter C. Peterson** has been elected president of the company.

**RAdm. Rawson Bennett**, USN (Ret.) has been elected a senior vice president of Sangamo Electric Co. and appointed the company's director of engineering.





## **THE MARINE...THE MISSION...AND TPS-34**

When minutes count, the call is traditionally for the Marines. And no matter in what atmosphere Marine combat units operate, they will soon be able to count on a new, versatile weapon—the TPS-34 ground controlled intercept radar.

Developed for the Marine Corps by Sperry, TPS-34 can be strategically transported in the thick of action by helicopter, cargo plane, truck or amphibious craft. A small crew can have it operating in less than eight hours . . . detecting both close-in and distant supersonic aircraft with but a single operator. Radar console and rotating antenna are housed in an inflatable radome, with the interceptor control shelter located nearby. The radar performs reliably even in the presence of hostile environments.

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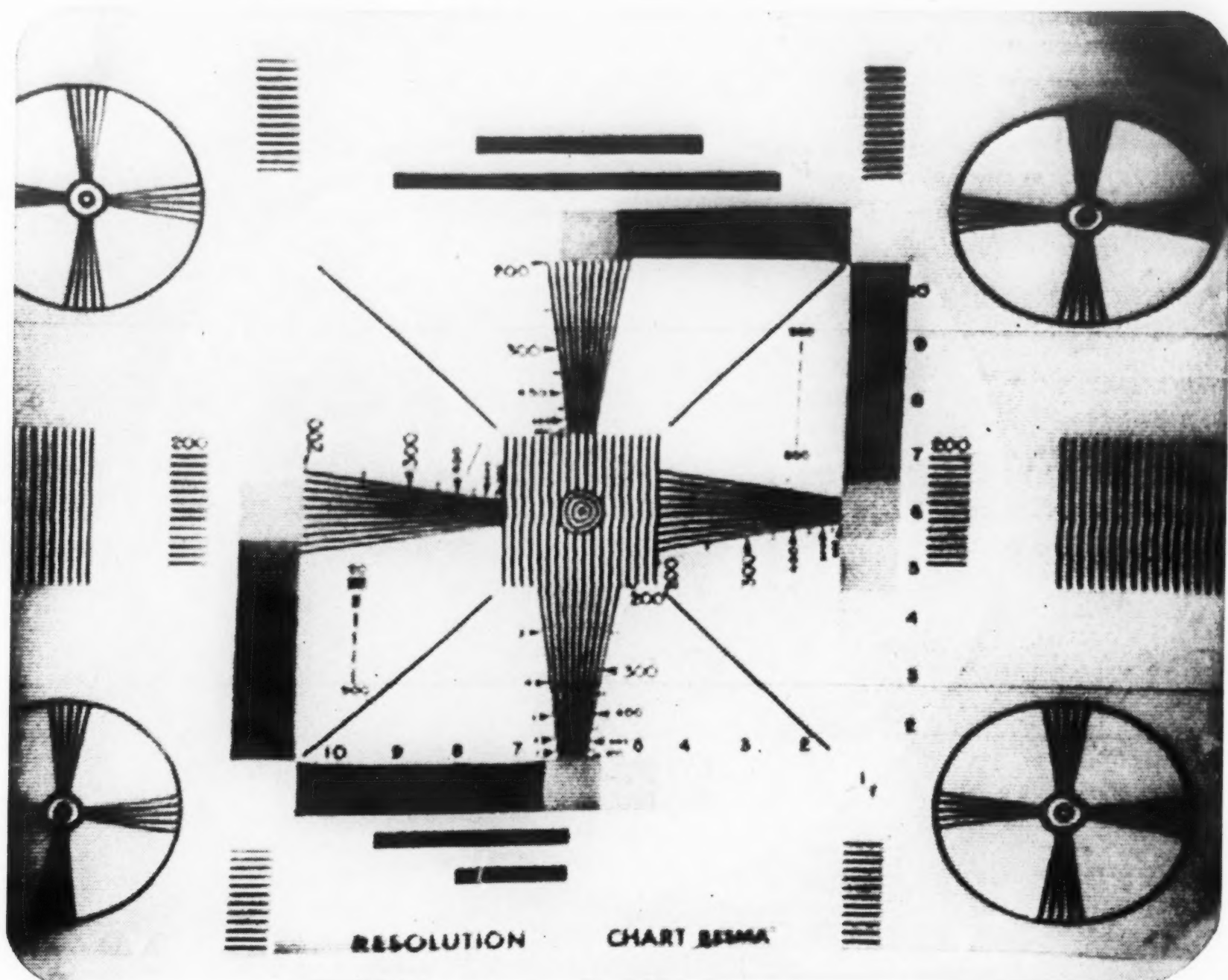
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Representative samples are evaluated to as high as 1000 cycles, 44 G's vibration.

A complete line of the new IO's is available for immediate delivery. For more information on General Electric super-ruggedized image orthicons, and other special purpose tubes, contact the General Electric Co., Camera Tube Section, Cathode Ray Tube Dept., Building 6, Electronics Park, Syracuse, New York.

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